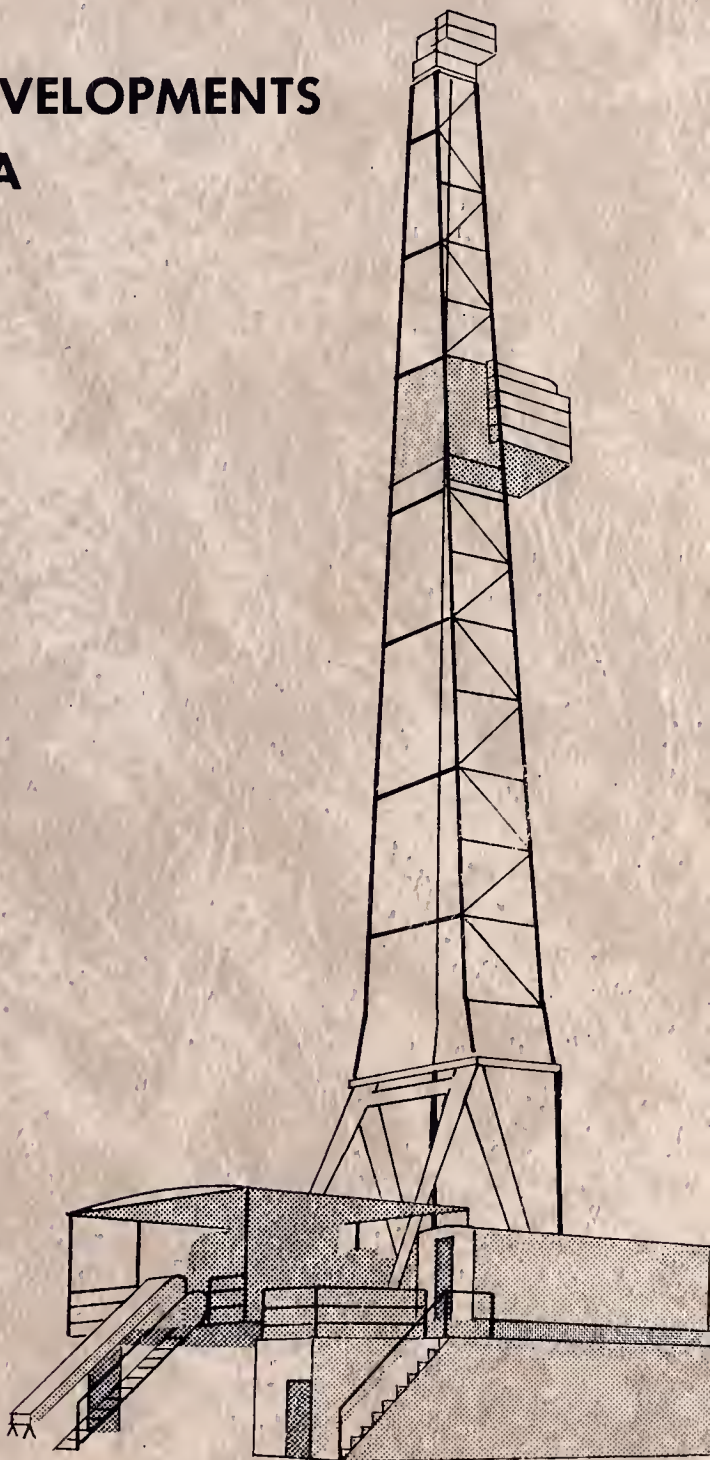


OIL AND GAS DEVELOPMENTS IN PENNSYLVANIA IN 1968



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Oil and Gas Developments in Pennsylvania in 1968

**by Dana R. Kelley, William S. Lytle,
Walter R. Wagner, and Louis Heyman**

PENNSYLVANIA GEOLOGICAL SURVEY
FOURTH SERIES
HARRISBURG
1969

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OIL AND GAS DEVELOPMENTS IN PENNSYLVANIA IN 1968

By

Dana R. Kelley, William S. Lytle,
Walter R. Wagner, and Louis Heyman

ABSTRACT

Oil and gas activities in Pennsylvania in 1968, were highlighted by a number of significant developments. Extensive Upper Devonian pre-Speechley gas development in Armstrong, Clearfield, Indiana, and Jefferson Counties, and very recent Clarendon-Speechley gas development in extreme southern Fayette County indicate excellent possibilities for significant widespread extension of old shallow gas fields to the east in an area subparallel and adjacent to deep Oriskany gas fields and structural trends. These developments demonstrate the potential of the sparsely tested deeper Upper Devonian sandstone reservoirs between the two areas and to the northeast and southwest on general stratigraphic strike. In Venango County excellent primary development completions were reported from the Upper Devonian Venango Second Sandstone which attests to the potential of significant reserves yet to be recovered from old oil fields. Other widely distributed good shallow Upper Devonian completions verify that Upper Devonian gas and oil prospects are far from exhausted despite the number and extent of shallow fields and the long productive history of the industry in the Commonwealth. The predominance of stripper production and completions to date does not fairly characterize the future potential for shallow oil and gas development. Profitable wells can be drilled when consideration is given to restricting completions to favorably developed reservoir trends found by utilizing modern subsurface methods and techniques.

Development of excellent gas production from a fractured Onondaga-Oriskany reservoir in the Rager Mountain field of Cambria County, highlighted deep drilling activities during 1968. This faulted field is coincident with the crest of the Laurel Hill surface anticline and is notable for complete development under voluntary unitization requiring only seven wells. Most of the wells have been completed far in excess of 10 MMCFGPD, the largest being 50 MMCFGPD. Although most deep production in the Commonwealth has been characterized as gas, an increasing volume of Corning-grade crude oil, totaling about 100,000 barrels since July, 1965, is being produced in association with gas from the Medina sandstones of Crawford and Erie Counties. The potential of this, and other deep oil production, is largely unevaluated. Exploratory interest in the deep reservoirs of Pennsylvania has increased during the year, with attention concentrated on the relatively unevaluated carbonate reservoirs.

Pennsylvania had four discoveries during the year; Forest and Warren Counties each had an oil discovery and Somerset and Washington Counties each had a gas discovery.

There were 896 new wells drilled and 26 wells deepened during 1968. Of the 896 new wells, there were 470 oil wells, 233 gas wells, 66 dry holes, 101 service wells, 25 miscellaneous wells, and 1 stratigraphic test. The 26 wells deepened consisted of 21 gas wells, 1 oil well, and 4 dry holes. The 61 exploratory holes accounted for 167,490 feet of hole while the 734 development wells drilled 1,373,480 feet of hole. The total footage for the 922 wells amounted to 1,834,131 feet. Of the 61 exploratory tests, 23 were successful and 38 were dry for a success ratio of 1 in 1.7.

Crude oil production amounted to 4,101,000 barrels, a decrease of 7 percent over the 1967 production of 4,387,000 barrels. Proved oil reserves as of December 31, 1968, were estimated at 59,188,000 barrels. Natural gas production totaled 87,987,000 MCF (thousand cubic feet) as compared with 89,966,000 MCF in 1967. Gas reserves were estimated at 1,344,996,000 MCF at the end of the year. Gas stored in Pennsylvania's reservoirs on December 31, 1968, was 486,524,000 MCF; this amount is included in the above reserve figure. Natural gas liquids produced in 1968, amounted to 98,000 barrels. The natural gas liquid reserve at the year's end was 1,064,000 barrels.

Seismic activity in the Commonwealth increased to 23 crew weeks from 17 crew weeks in 1967. Interest in subsurface disposal of industrial effluents has greatly expanded during the year, accompanying increased local and national concern with pollution.

INTRODUCTION

The Pennsylvania Geological Survey has initiated a new format in the reporting of oil and gas drilling activities in the Commonwealth. In past years, the large number of poor completions has obscured the much smaller number of good completions to the point that a reputation for exclusively stripper production is now associated with oil and gas activities in the State. Similarly, cursory reports and descriptions of newly developed fields, without regard to the economics, have fostered the conclusion that the oil and gas industry in Pennsylvania lacks a future. Nothing can be further from the truth. In addition to a sparsely evaluated, deep prospective Ordovician and Cambrian section and many untested Silurian and Lower Devonian prospective intervals, there are widely distributed good completions being made in the known old producing zones. The change in format will emphasize the good completions being made by presenting data made available to the Survey pertinent to these attractive developments. It will become apparent that the long productive history of the State and extensive stripper production in no way precludes the excellent potential for significant reserves of oil and gas in old as well as new horizons so near to a major industrial market for hydrocarbons.

The large number of stripper wells is mostly a result of the long history of a locally founded and nurtured industry. Technological advances have been slowly accepted and even more slowly applied. Many cable tool wells are still being drilled as multizone open hole natural and/or shot completions, a method similar to that originally developed during the founding of the industry at the turn of the century. Low overhead operations on fee or long-term leased land have and still do support profitable stripper operations. However, minimal cost completions with limited or no application of modern technology may leave considerable recoverable hydrocarbons in the reservoir so that full economic potential

is not realized. In addition, modern geological and geophysical evaluation methods are not applied, except by a few of the larger local companies, to locate exploratory and development drilling sites. Consequently, the majority of wells continue to be strippers. Good completions which occur in limited areas of maximum reservoir development and utilize modern completion methods are small in number and widely dispersed. It is these highlight wells, however, that demonstrate that very profitable completions can be expected in limited areas of maximum reservoir development delineated by modern geological and geophysical exploratory and development methods.

The change in format initiated in this Progress Report consists of a division of the publication into two major parts. The first part draws attention to and briefly describes completion and other highlights for the year past. The second part contains the statistics for the period. It is hoped that this modification, and future refinements of the new format, will help to establish an improved basis for interpreting the meaning of data presented, since the tabulations themselves are of limited value without a foundation of what factors compose the figures and how they are obtained.

A Survey goal is to establish stratigraphic consistency in the reporting of shallow oil and gas sands. Even today, after 100 years of drilling, no agreement on stratigraphic correlation exists. Within one field the same sand may have several names or conversely several sands may have the same name. The most practical method of solving these correlation problems is to publish gamma-ray logs which are representative of specific areas and to apply names to certain sands. A separate publication, Progress Report 178, is the first step toward the goal of consistent usage and is designed to accompany this and subsequent oil and gas development progress reports.

Progress Report 178 contains three shallow gamma logs, two from the oil belt and one from the gas fields. Each log is divided into the Pennsylvanian, Mississippian, and Devonian Systems, and the Devonian is further subdivided into four zones from "A" the oldest, to "D" the youngest. Pending the results of correlation studies, individual sandstones are not identified on the preliminary type logs but are placed in boxes within the zone where they belong for identification of reported producing intervals. It will also contain a representative deep log for western Pennsylvania. The various horizons designated in the literature and by local usage are labelled, and intervals having shows or production are shown.

The logs in Progress Report 178 supersede the generalized stratigraphic columns formerly presented in the annual oil and gas development reports.

ACKNOWLEDGEMENTS

The cooperation of the Bradford District Producers Association has been extremely helpful. Appreciation is extended to the Pennsylvania Department of Mines and Mineral Industries whose Oil and Gas Division has furnished and shared oil and gas drilling data. The Department of Forests and Waters and the Pennsylvania Game Commission have also been helpful by sharing new data. Appreciation is extended to operators and companies who released data pertinent to highlight well completions.

HIGHLIGHTS

COMPLETION HIGHLIGHTS FOR 1968

Shallow Upper Devonian Highlights

The lower limits used in considering a shallow Upper Devonian completion as a highlight well are an initial potential in excess of 50 BOPD for oil and in excess of 2 MMCFGPD for gas. Without weighing such variable factors as acreage costs, interest, overhead, taxes, post-completion expenses, and changes in market conditions, the above limits essentially represent wells producing at full capability with average decline, having a payout in the vicinity of 3 to 4 months and a return of approximately \$6 for \$1 invested in three years. In obtaining the above figure an average depth of 1,000 feet was assigned for an oil well and 3,000 feet for gas; \$10/foot completed well costs with oil at \$4/barrel and gas at \$0.275/MCF was used.

A total of 30 shallow highlight wells was reported this year, 12 gas and 18 oil. This represents 4 percent of the total shallow wells successfully completed. These were drilled in 17 fields in 9 counties. There were 15 pre-Speechley completions (Zone B of Progress Report 178), 11 gas and 4 oil; 11 completions in the Speechley to Pink Rock interval (also Zone B), 1 gas and 10 oil; and 4 oil completions in the post-Pink Rock Upper Devonian sandstones ("Venango Group," Zone D).

Figure 1 shows the distribution of the shallow highlight wells. Geophysical logs and some additional scout information was obtained from some operators for a number of these wells. The following is a brief description of those highlight occurrences about which information was released. Unfortunately, data beyond that submitted in Department of Mines and Mineral Industries well records could not be acquired prior to publication for the highlight wells and/or areas not discussed further.

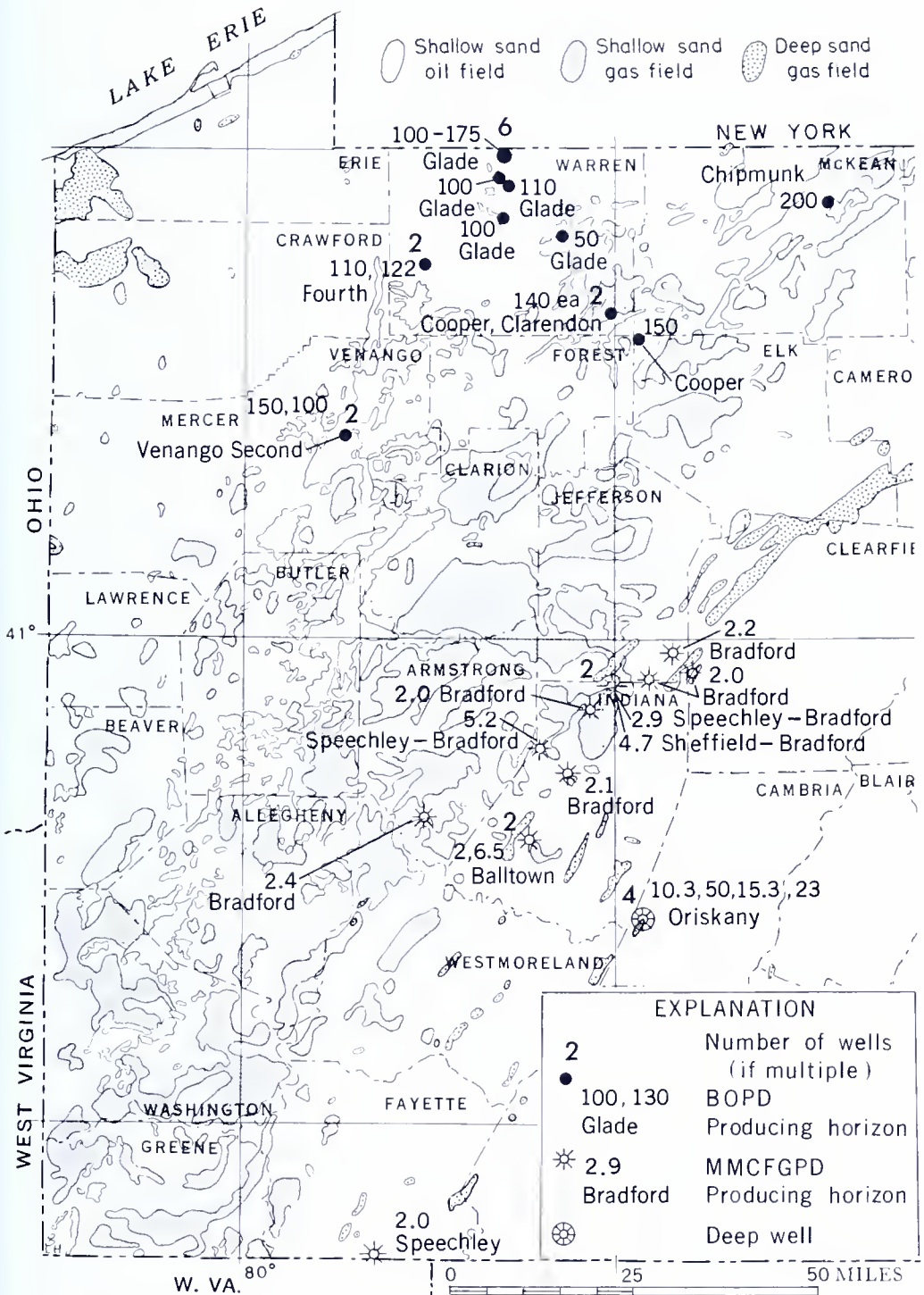


Figure 1. Highlight wells for 1968.

*Pre-Speechley Development and Highlight Wells in
Armstrong, Clearfield, Indiana, and Jefferson Counties*

Considerable new development for deeper Upper Devonian gas occurred along the eastern edge of the old gas fields in central-western Pennsylvania during 1968. New development and step-out drilling, plus the deepening of old wells accounted for 142 development wells of which 11 (8 percent) are highlights (Figure 2). Completed producing wells had initial potentials ranging from 21 to 5,212 MCF with a frequency of initial potentials as shown by the following table.

INITIAL POTENTIAL (MMCFGPD)

	Dry Hole	<u><0.9</u>	<u>1-1.9</u>	<u>2-2.9</u>	<u>3-3.9</u>	<u>4-4.9</u>	<u>>5</u>	Total
Number of Wells . .	6	85	40	8	0	1	2	142
Percent of Total . .	4	60	28	6	<u>2</u>			100

Excluding dry holes, approximately 1 percent were drilled as open-hole natural completions, 3 percent as open-hole hydrofractured completions, and 96 percent as hydrofractured completions through pipe cemented on bottom. The majority of completions are from a number of separate sandstone zones, the production being nonstaged and comingled. Total depths range from approximately 3,000 to 3,800 feet. Completed well costs range from \$10 to \$11 per foot. Previous completions in the pre-Speechley reservoirs in this general area are reported to have a slow decline and thus are very attractive economically.

Development has been widespread and the large majority of wells apparently are not located in areas of optimum reservoir development for one or more of the sandstone pay zones, the trends of which are not coincident. Highlight wells are similarly widespread because of the multiple reservoirs present. Figure 3 is a cross section of highlight well geophysical logs which illustrates some of the pay zones and the rapid lateral changes in development of reservoir sandstone typical of the area. Five separate sandstone zones produce in the area of these highlights, the sands being locally designated as Balltown, Sheffield, Bradford, and Kane sandstones, although in most cases they appear to be stratigraphically lower than sandstones of the same name in the older oil producing areas to the north. Various companies involved in this development include Peoples Natural Gas Company, Consolidated Gas Company, Kewanee, Mid-Atlantic, T. W. Phillips, and a number of independents.

The highlighted new development wells significantly extend shallow gas production to the east of the older shallow Upper Devonian gas fields

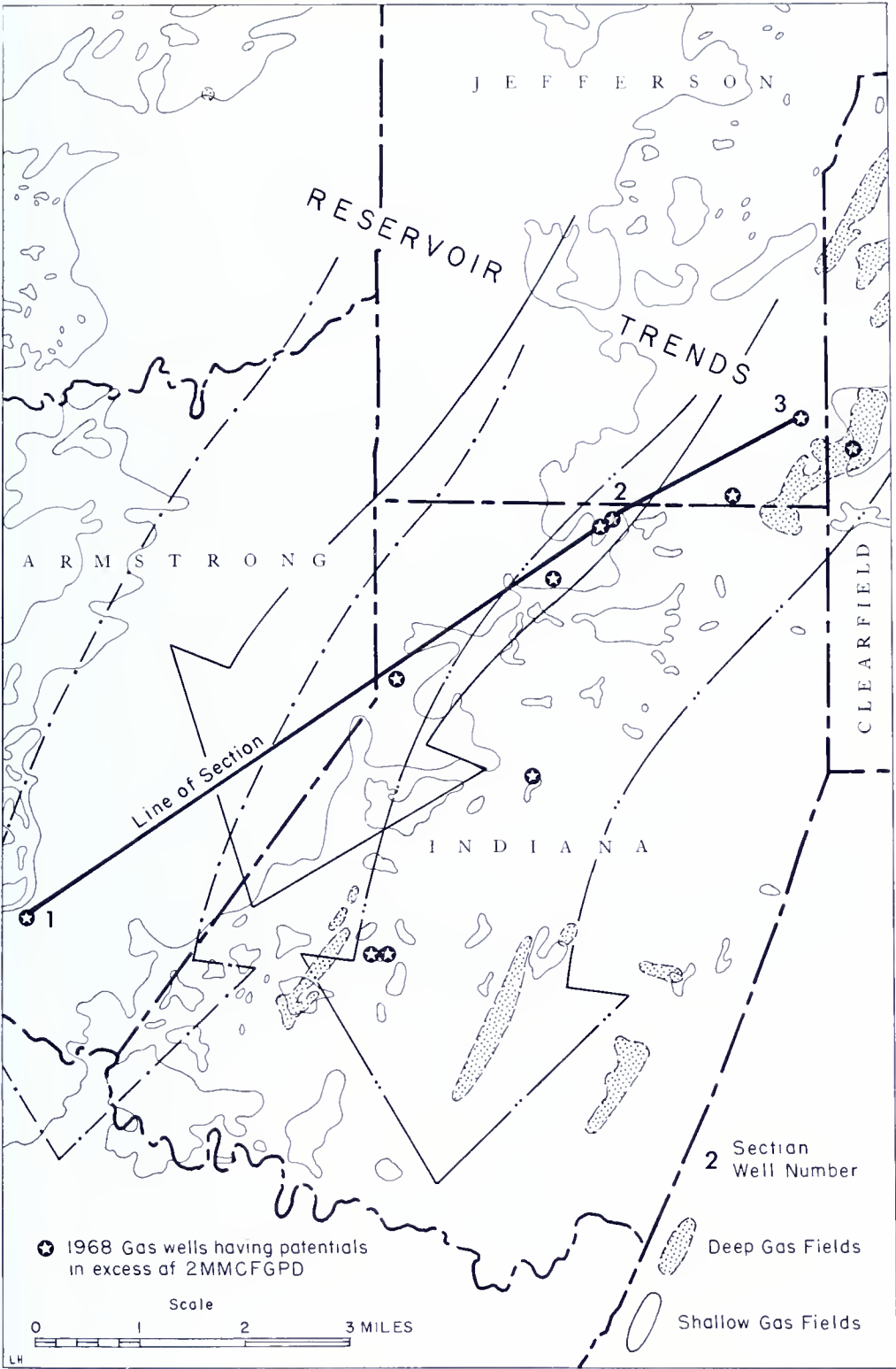


Figure 2. New significant shallow gas development along eastern edge of old gas fields.



and open up a potential for shallow gas reserves in and about deep Oriskany fields and structural trends along the eastern edge of the Plateau. Development of these new deeper Upper Devonian reservoirs can be expected to continue in areas that are essentially unevaluated both to the northeast and southwest of the highlighted area and may result in significant new reserves of gas. More detailed geological evaluation should delineate trends of optimum reservoir development, decrease random drilling and/or deepening, and greatly improve the percent of highlight well completions.

Glade Sandstone Development with Highlight Wells Continued in Warren County

Development of oil production from the Glade Sandstone in Warren County was continued in 1968 by a number of independent operators. This development was concentrated mostly along the southeastern edge of, and to the south and east of, the Sugar Grove Glade field (Figure 4). There were 18 wells of which 6 were highlights (33 percent) reported this year. Of the 18 wells 2 were dry. Total depth is approximately 600 feet. Initial potentials ranged from a few barrels per day to 175 BOPD. Most of the wells are hydrofractured completions in open hole, the pay zone being 30 or more feet of well-developed sandstone, the lower portion of the zone being the primary pay. A typical geophysical log of the Glade Sandstone from the highlight development area is shown in Figure 4. Some development of Glade production is anticipated to continue to the east and south of the Sugar Grove field in 1969, although an absence of geological and engineering data makes the development potential difficult to ascertain. It is not known whether greatly improved productive capability would result from treatment through pipe and a light acid wash as it has in other Glade Sandstone producing areas to the south. Nevertheless, a significant number of highlight oil completions have been reported for the Glade Sandstone in this area, which should stimulate interest in this reservoir in northwestern Pennsylvania. Hopefully, more information may soon become available and a more definitive appraisal can be made.

*Venango Second Sandstone Oil Potentials Highlight
Significant Recoveries Being Obtained from Old Fields*

In November, 1968, Quaker State Oil Refining Company reported two pumping completions in the Venango Second Sandstone in the old Foster-Reno field of Venango County, one with an initial potential of 105 BOPD and the other with 150 BOPD after hydrofracture treatment of limited open-hole perforations in the sandstone. Total depth is in the vicinity of 500 feet. Nearby portions of this old Venango Second

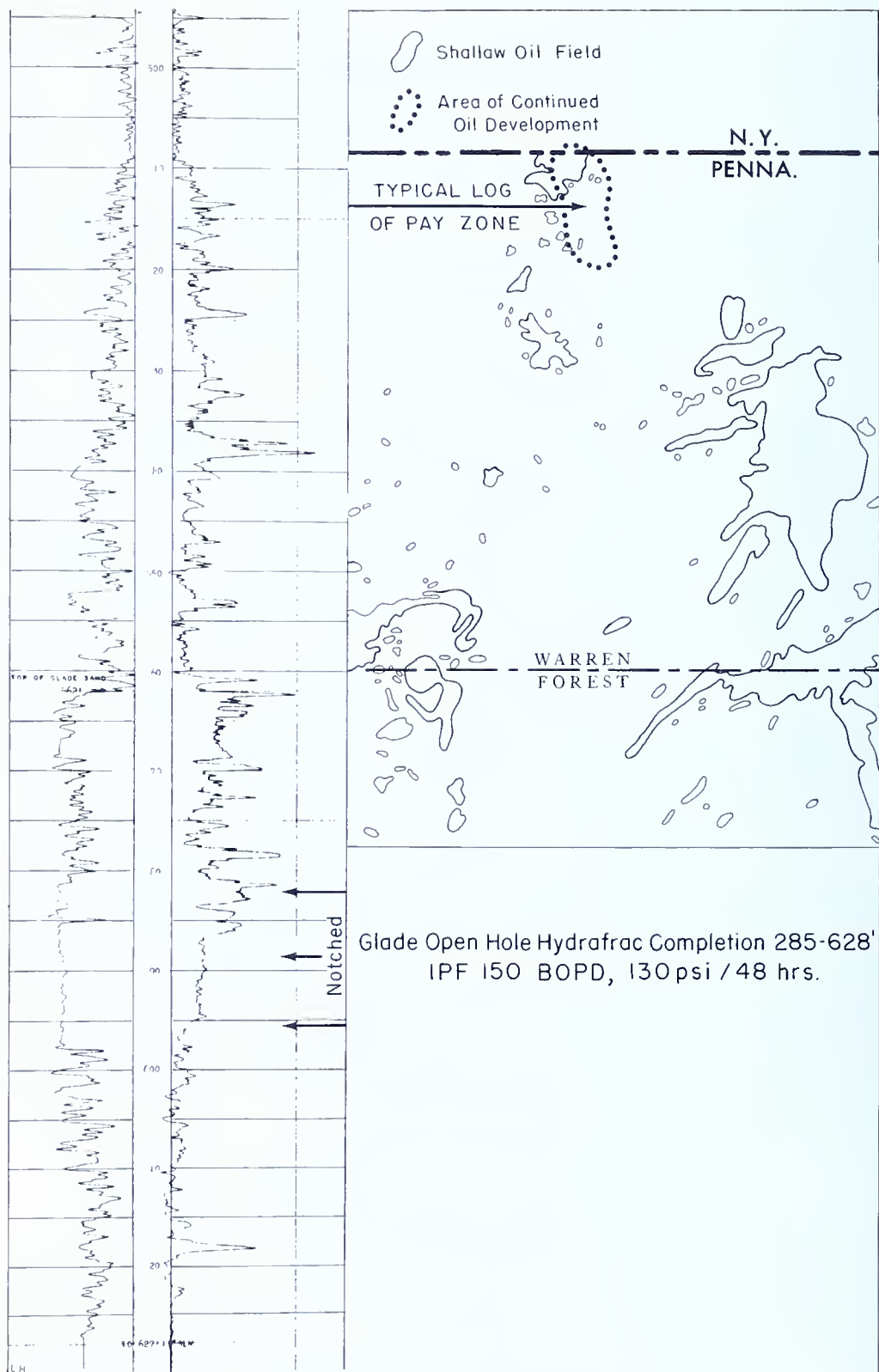


Figure 4. Significant shallow oil development continues in northern Pennsylvania Upper Devonian Glade Sandstone.

field had undergone various secondary recovery experiments with limited success approximately four years ago. The wells were completed within the trend of optimum sandstone development (Figure 5).

A number of primary completions are being made yearly in old fields and in zones once considered depleted. Improved completion techniques including hydrofracture treatment have resulted in this new production. Maximum and effective reservoir drainage apparently had not occurred in open-hole, nitroglycerin shot wells drilled at the turn of the century. However, production volumes in the category of highlight wells as defined in this report had not been reported up to this date for redrilling to so-called depleted reservoirs. Although these highlight wells are considered primary completions, it is not known whether the volume of production is related to a residual effect from the four year old unsuccessful secondary recovery experiments. Regardless of any residual effect, these wells highlight the potential for significant new oil recovery in the many old shallow fields of Pennsylvania, and stimulate the interest in recovery of the majority of the oil still left in the ground in these old fields.

Speechley-Clarendon Potential in Fayette County

Highlights Possible Gas Development in Southwestern Pennsylvania

In November of 1968, new gas development in the Clarendon-Speechley interval at depths of 3,000 feet was reported in extreme southern Fayette County along the Pennsylvania-West Virginia state boundary. Zenith Exploration reported an initial potential of 2 MMCFGPD after hydrofracture treatment of perforations through pipe in the Clarendon Sandstone (locally designated the Stray Sandstone) and the Speechley Sandstone. Additional wells are being drilled and planned. The area of potential development and the producing intervals are shown on Figure 6.

Similar to significant new Upper Devonian gas development in Armstrong, Clearfield, Indiana, and Jefferson Counties noted above, this reported good Speechley production in Fayette County occurs along the eastern edge of the old gas fields and near and between deep Oriskany structural trends and gas fields. The pre-Speechley gas development to the north occurs in zones developed along the eastern edge, and to the east of overlying Speechley fields, many wells have been drilled deeper to evaluate these horizons. Considering the subparallel relationship of development to the north with Oriskany trends and fields and with overlying Speechley fields, considerable potential for significant gas development can be anticipated between the two areas in Pennsylvania and to the southwest in West Virginia in the Speechley and in the deeper multiple pre-Speechley reservoir zones which had not been well evaluated.

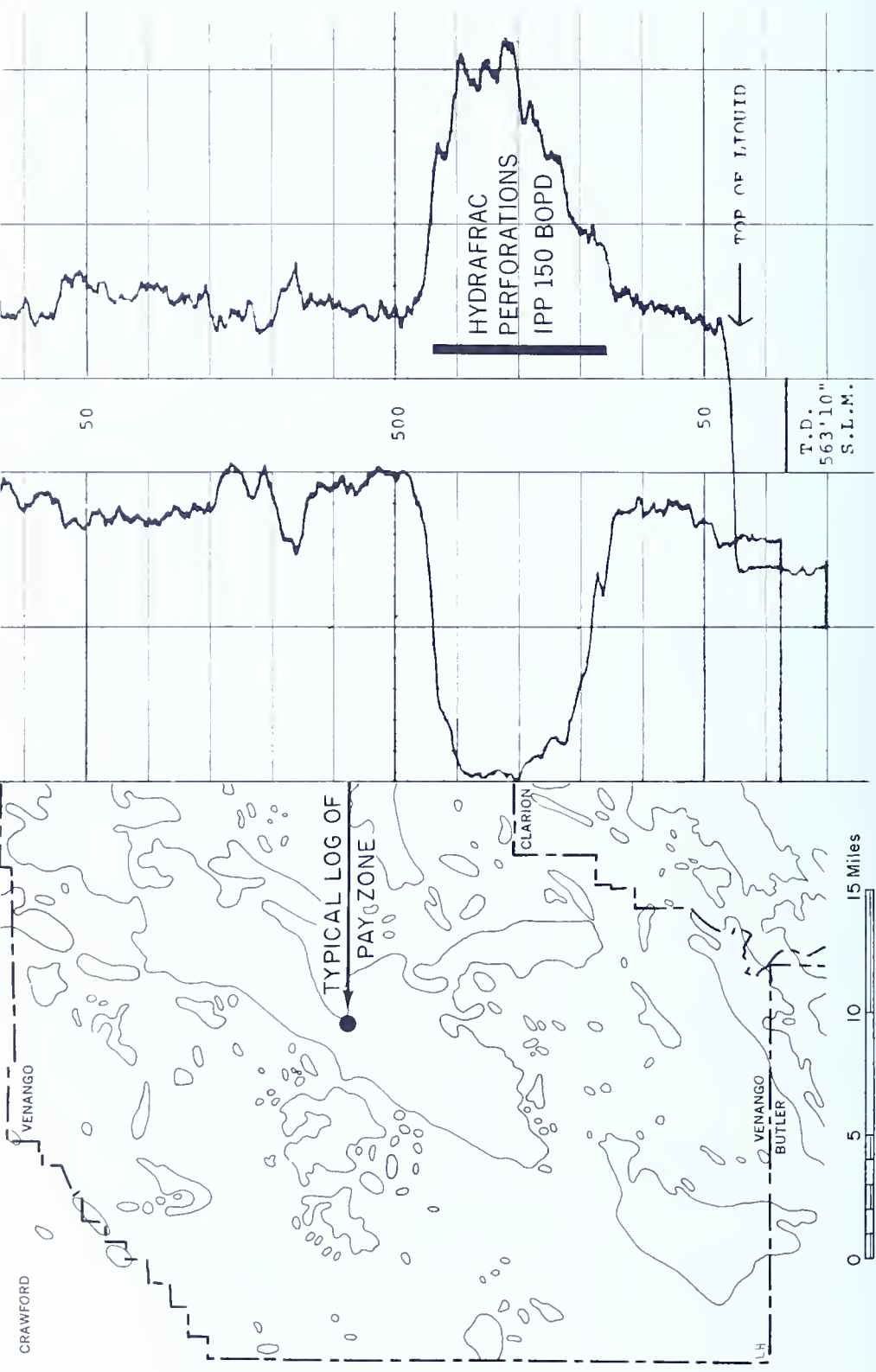


Figure 5. Significant shallow oil recovery obtained from old fields of Upper

Devonian Venango Sandstone

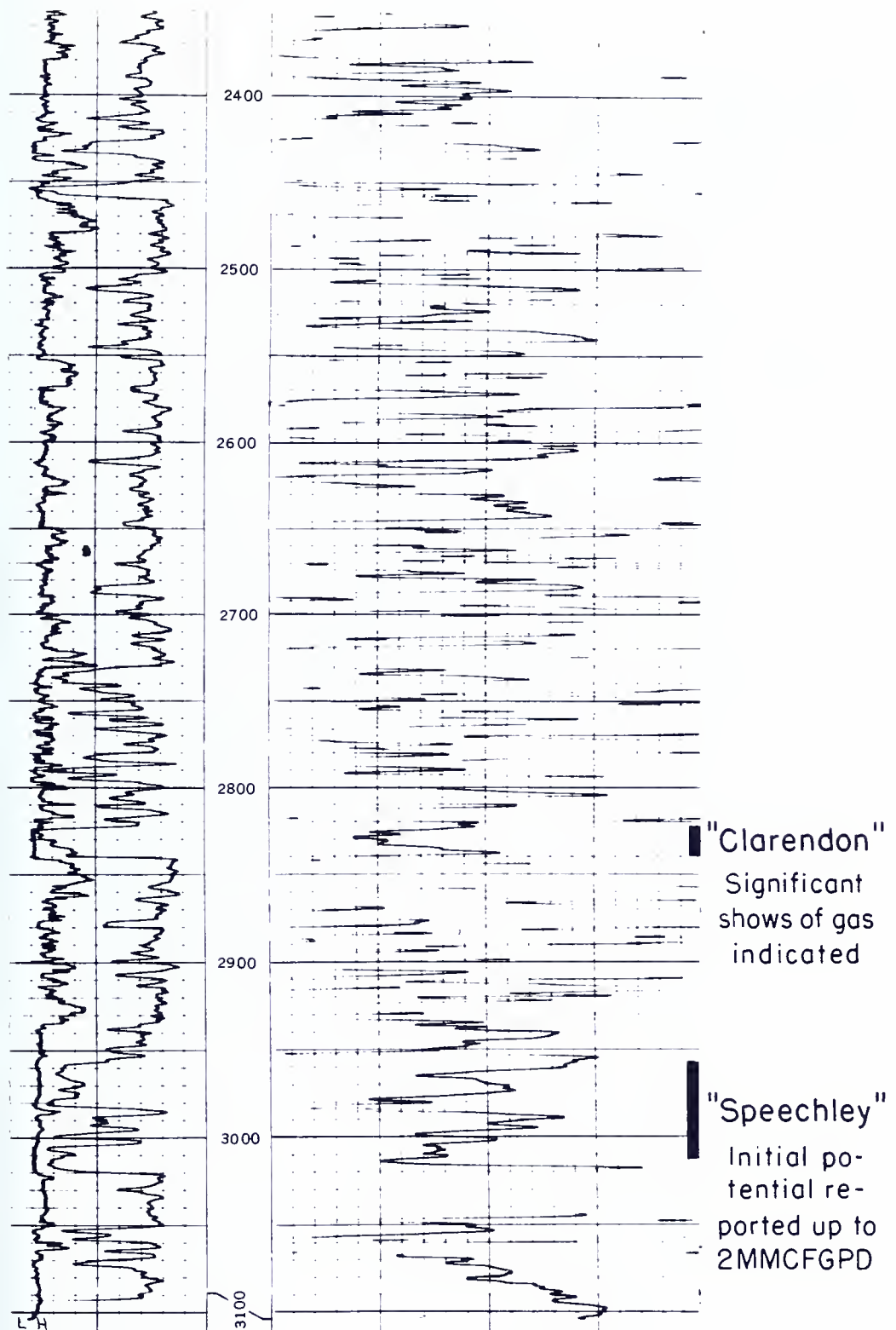


Figure 6. Significant gas development reported for Upper Speechley sandstones.

Deep Highlights

The lower limit used in considering a deep completion as a highlight well is arbitrarily designated as 10 MMCFGPD. There were eight reported nonstorage deep gas wells successfully completed during the year of which four (50 percent) are considered highlights. They are all in the recently developed Rager Mountain field of Cambria County.

Northeast Extension of Rager Mountain (Onondaga-Oriskany) Gas Field, Cambria County, Pennsylvania

A major deep gas development highlight in 1968 was the northeast extension of the Rager Mountain gas field. The primary extension well, Peoples Natural Gas No. 1 G. L. Reade, (Well No. 3, Figure 7) was completed October, 1965, with an IP of 15 MMCFGPD natural. It is located along the structural axis and near the crest of the Laurel Hill surface anticline. Only one other well was drilled that year, one in 1966, one in 1967-68, and the final three in 1968. The four wells reported in 1968 had potentials ranging from 10.3 MMCFGPD to 50 MMCFGPD.

The deliberate pace of development is contrasted with the rapid development and overdrilling of many of the earlier Middle-Lower Devonian gas pools. This is reportedly due to the voluntary unitization of a tract of 7,462 acres along the surface axis of Laurel Hill anticline. This area was accepted by the Conservation Commission as including the probable reservoir, and drilling units not less than 600 nor over 750 acres in size were agreed on. Peoples Natural Gas, Fairman Drilling Company, and T. W. Phillips Oil and Gas are the operators in the field, although other interests are represented in the units.

The structure is faulted, but the fault pattern is mainly parallel to the structural axis on both flanks of the structure, and all the wells are in the same fault block, with a continuous reservoir as demonstrated by common well pressures in the field. The faulting was found by geophysics and has been verified by subsurface mapping. None of the wells is known to have cut faults. The structure is closed on the southwest by down-to-the-south subsurface faulting between Well No. 5 on the up-thrown block and dry holes No. 7 and No. 1 on the downthrown block. This subsurface fault is located at or near the culmination of the surface structure (Figure 7).

Production is from fractures in the Onondaga Chert and "Oriskany" (Ridgeley) Sandstone. Fracturing is most likely related to the faulting. Control of gas production by intensity of the fracture network is indicated by the contrast of Well No. 6 (Don -5457), which penetrated the full pay section of Onondaga Chert and Oriskany Sandstone into the subjacent Helderberg, yet had a natural potential of only 440 MCFGPD and a potential of 5 MMCFGPD after fracture treatment, with well No.

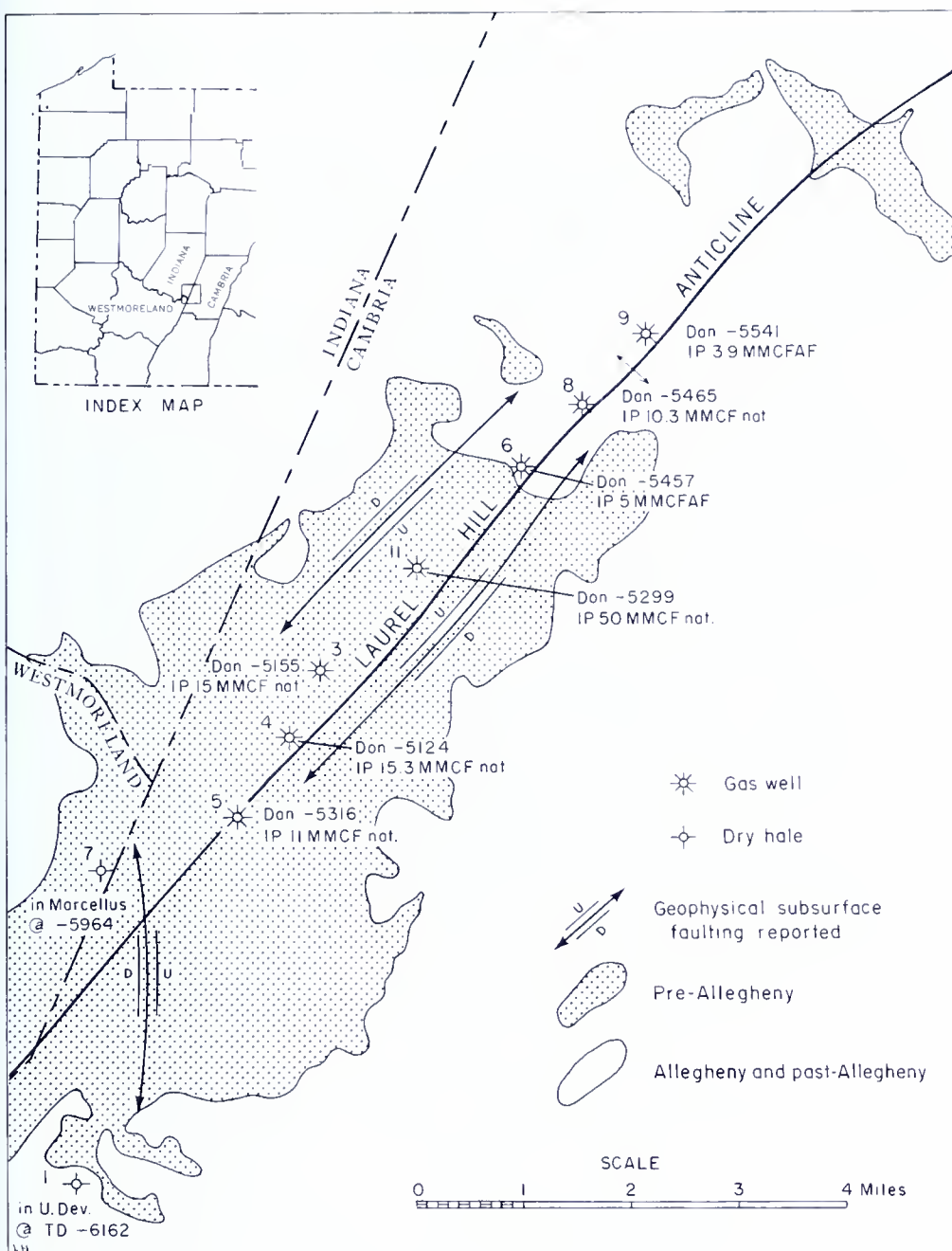


Figure 7. Northeast extension of Rager Mountain gas field.

11 (Don -5299), which had a natural potential of 50 MMCF GPD although it did not reach the Oriskany at total depth.

Original shut-in pressure was 3,235 psi, and present shut-in pressure is about 2,400 psi. The field appears to be of better than average quality, with a low pressure decline for the amount of gas produced.

Depths to the top of the pay range between 7,600 and 7,900 feet, depending on both structural position and local relief. Completed wells cost an average of \$14 per foot.

The seven wells are believed to be efficiently draining the field and no further development is contemplated. The excellent potentials reported during this extension of the Rager Mountain field in 1968, highlight that significant gas reserves can still be anticipated on structure from old exploited deep horizons in Pennsylvania.

*Reported Oil Production from the Medina Sandstone in
Northwestern Pennsylvania Significantly Increases*

The Lower Silurian Medina Sandstones of Erie and Crawford Counties are considered primarily gas reservoirs. However, a considerable amount of oil has been produced with the gas. Although accurate Medina production fluid cut figures are not required or available for Pennsylvania, operators report that nearly all wells produce some oil and water with the gas. Available data indicates a significant increase in oil production has occurred recently. In 1966, marketed oil was reported to be 11,921 barrels and in 1968, 58,991 barrels were sold. Assuming all wells are producing some oil, the average well would approximate 1 barrel of oil per 125 MCF in 1966, and 1 barrel of oil per 26 MCF in 1968. This represents an increase of nearly 90 percent in oil production per well.

The primary area of oil production is Crawford County from the Indian Spring and Kastle pools. There is also a minor amount produced in Erie County from the southern margins of Bushnell-Lexington and Lundy's Lane pools. Although nearly all have been reported to produce some oil with the gas, a total of only 39 wells with oil shows from the Medina have been recorded by transmitted scout information from these counties. However, there are many wells which lack an oil show during drilling, but which make oil during production.

The oil appears to be coming from the lower part of the pay section, probably the lower Grimsby and Cabot Head sandstones.

The lack of an oil-gas contact and the high gas-oil ratio makes the existence of a distinct oil zone unlikely. The amount of oil reported at completion ranges from a "show" to 50 barrels per day. The gas-oil ratio from one well in Indian Spring, for which both oil and gas production information has been released, averaged 28 MCF per barrel. It is likely that this is a representative figure, being in line with the average GOR (gas-oil ratio) per well grossly estimated above.

The oil is a black, Corning-grade, mixed base, 37° gravity, sweet crude, and the present posted price is \$2.88 per barrel. Between July 1965 and the end of 1968, the Ashland Oil Company purchased a total of 97,288 barrels of which 89,433 barrels came from Crawford County.

Deep Horizons Highlight Exploratory Interest in 1968

Requests for subsurface data and visits to the Pittsburgh office of the Pennsylvania Geological Survey this past year indicate considerable industry exploratory interest in the hydrocarbon potential of deep horizons in the State, particularly carbonate reservoirs poorly evaluated or sparsely tested by drilling to date. Of most interest is the postulated occurrence of a barrier reef trend and associated shelf and basinal patch reef reservoirs in the Silurian Guelph or Lockport horizon extending across the northwest corner of Pennsylvania. This trend is believed to connect the occurrences of these reservoir facies from productive areas in Canada with those in Ohio. The incidence of vugular reef limestones and scattered significant shows of gas along with the characteristic black sulfur water shows from the Lockport attest to the prospectiveness of this horizon for discovery of future gas reserves. Exploration geologists and operators have also been investigating the possibilities of productive Devonian Onondaga patch reef reservoirs extending from New York into Pennsylvania.

The occurrence of salt solution structural entrapment of Devonian Oriskany gas in extreme northwestern Pennsylvania has stimulated exploratory interest in the Oriskany west of the folded belt where structural plays for development of reserves from this horizon have historically, and at present, been concentrated. In addition such solution structure has led to interest in reinterpretation of structure in Oriskany fields associated with the prominent anticlines of the folded belt. Resolution of the mechanics and meaning of multiple complex, low-throw faulting in these fields could lead to a more accurate interpretation of deeper structure and delineation of prospects in pre-Oriskany horizons negligibly evaluated by the drill to date.

DATA AVAILABILITY IN CURRENT STUDIES

The Pennsylvania Geological Survey has recently initiated a number of projects intended to compile and make readily available all subsurface information to industry, the public, and government. A few of these projects are briefly noted below.

1. Mylar base maps at a scale of 1 inch to a mile and comprising four 15-minute topographic quadrangles in areal extent are being prepared for western Pennsylvania. All wells on record since the advent of the Oil and Gas Laws will be spotted and identified by quadrangle map number on a latitude and longitude grid with major towns and rivers shown. Elevation and total depth for representative wells will allow appraisal of deepest penetration in any area. Symbols will indicate if geophysical logs and sample data

are available. Prints of the base maps and a generalized field outline map will be available. The bases and overlays will be brought up-to-date monthly.

2. Preparation of an initial series of Upper Devonian surface to deepest sandstone regional geophysical log sections across the oil and gas-producing belt in western Pennsylvania is in progress. The purpose of these sections is to illustrate producing zones and general subsurface facies changes and to standardize interval correlations. All occurrences of fluids, commercial limestones, clays, and coals reported in the vicinity of the type logs used will be noted. A similar project will be initiated this year for the Tully-Queenston interval.
3. Compilation of various types of subsurface data in tabular and graphical form is in progress. Currently all brine analyses are being compiled, and the stratigraphic position of the analyzed waters is being appraised to afford some estimate of the validity of the occurrence of analyzed waters, a factor lacking in previously released brine analyses. Presentation of this data will include tabulations arranged in such a way that supplements can be readily incorporated in the future. The compilation of important subsurface data will subsequently include porosity-permeability relationships and such other reservoir factors as grain density and velocity, fluid composition, temperature, and pressure. In the future it is planned that such data as grain size analyses, clay and carbonate cement analyses, and composition and nature of hydrocarbons will be compiled and published. Also, pertinent surface measured sections will be assembled and made available.

OIL AND GAS INDUSTRY ACTIVITY BENEFIT OF WELL DATA AND BASIS OF STATISTICS

Reliable subsurface oil and gas well data are necessary for expansion and promotion of the oil and gas industry, as well as other subsurface appraisals. Such data are also necessary for effective evaluation of subsurface storage or disposal potential, subjects of increasing interest in Pennsylvania. The development of brine production, fresh water zones, and industrial mineral zones also requires reliable subsurface data.

Because local oil and gas companies and operators can benefit from an expanding oil and gas industry as well as from comprehensive subsurface evaluation, it is in their own best interest to report prompt and accurate well data. Delayed reporting of data results in a mistaken impression of current oil and gas development activity. Incomplete or inaccurate re-

porting results in erroneous interpretations or evaluations of subsurface potentials.

Meaningful benefits will accrue to the producers and developers in Pennsylvania, to the economic well being of the Commonwealth, and to the national oil and gas industry when prompt, accurate, and complete well data are reported.

To standardize the Pennsylvania Geological Survey's compilations of well data in this annual report, and in submittals to national industry organizations for which the Survey is responsible, the following statistics reflecting oil and gas activity in the Commonwealth are entirely based on drillers' records and location plats forwarded to the Pennsylvania Geological Survey by the Department of Mines and Mineral Industries, Oil and Gas Division, the administrative and regulatory agency for the Oil and Gas Laws. The figures released by the Survey afford a basis only for a general appraisal of industry activity within the State during the past year.

PREVIOUS COMPILATIONS

The deep well summarized records (those which reached rocks of Middle Devonian age or older) are shown in Table 11 and their locations on Figure 8. Deep well summarized records of wells drilled in 1967, whose logs were not available until 1968, are shown in Table 12. For those deep wells drilled prior to 1950, the summarized records and other information on the Commonwealth's oil and gas activities are to be found in Bulletin M31. Similar information for the 1950 to 1954 period was published in Bulletin M39 and for the 1955 to 1959 period in Bulletin M45. For the years 1960 through 1967 this information was published annually in Progress Reports 158, 160, 165, 166, 168, 172, 173, and 175 of the Pennsylvania Bureau of Topographic and Geologic Survey. Oil and gas developments in the shallow sands (Upper Devonian or younger) are described in Bulletin M45 and Progress Reports 135, 139, 143, 144, 147, 150, 151, 154, 155, 157, 158, 160, 166, 168, 172, 173, and 175.

A list of deep well samples on file with the Survey was published in the Survey's Catalogue of Deep Well Samples (W. R. Wagner, IC16). Supplemental lists were published in Progress Reports 157, 158, 160, 165, 166, 168, and 173. These and other deep and shallow well samples, geophysical logs, and other well data are also on file with the Survey.

INDICATED STATUS OF LOCAL INDUSTRY

The following brief summary statements are based on information as reported and submitted to the Commonwealth and herein compiled by the Survey. Some delayed reporting and incomplete information on sub-

mitted well records does affect the statistics to some degree. It is believed, however, that the gross status of the local industry presented in these summary comments is reasonably correct to the best available public knowledge. The conclusions drawn below will be similar to those nationally derived, inasmuch as they are based on the same data.

No attempt is made to define or discuss causes contributing to the trends indicated. Important refining and marketing fluctuations influencing industry activity are beyond the scope of this report and are not reflected by the data available. Consequently, the comments below are restricted to only the end results indicated by drilling and completions reported to the Commonwealth.

A gradual decline in oil reserves (6 percent) is accompanied by a similar gradual decline in oil production (7 percent) although the number of completed oil wells increased during the year (64 percent). Much of the increase in completed oil wells is attributable to expanded secondary recovery projects. It appears that whether by primary or secondary operations, the local industry is not developing enough oil to supplement or hold reserves steady, much less increase production. More wells are necessary to produce the oil and establish reserves than in the past year.

Although there was a fair decline in completed gas wells (16 percent), gas production was only slightly off (1 percent) as were the reserves (3 percent). It appears that production and/or reserves per well has increased over the past year. Some of the difference is also attributable to an increase in completed wells converted into active gas storage projects.

DRILLING AND COMPLETIONS

Reported total wells drilled and deepened during 1968 increased 28 percent from 1967 (922 wells in 1968, 719 wells in 1967). While deep well drilling decreased (39 wells in 1968, due in part to a new reporting procedure, 67 wells in 1967), shallow well drilling increased (857 wells in 1968, 630 wells in 1967) and wells deepened increased (26 wells in 1968, 22 wells in 1967). Completed oil wells increased this year (471 wells in 1968, 269 wells in 1967) and gas wells decreased (254 wells in 1968, 304 wells in 1967). Excluding miscellaneous, service, and stratigraphic wells, the percentage of dry holes decreased from 12 percent in 1967 to 9 percent in 1968. The shallow dry hole percentage decreased from 11 percent in 1967 to 8 percent in 1968, and the deep dry hole percentage increased from 25 percent in 1967 to 50 percent in 1968. Total footage drilled increased 17 percent (1,834,131 in 1968, 1,569,717 feet in 1967), and exploratory and development footage increased 5 percent (1,540,970 feet in 1968, 1,471,281 feet in 1967). The greatest increase in footage drilled reflects an increase of 108 percent in service, miscel-

laneous, and stratigraphic wells drilled in 1968 (127 wells in 1968, 61 wells in 1967).

A total of 896 new wells were drilled during the year and 26 wells were drilled deeper. Of the 896 new wells, there were 470 oil wells, 233 gas wells, 66 dry holes, 101 service wells, 25 miscellaneous wells, and 1 stratigraphic test. Of the 26 wells drilled deeper, there were 21 gas wells, 1 oil well, and 4 dry holes. Of the 896 new wells, 39 were deep wells of which 22 were drilled for gas storage, 8 were gas wells, 8 were dry, and 1 was drilled for liquid waste disposal. A classification of the wells drilled in 1968 exclusive of service wells, miscellaneous wells, and a stratigraphic test is shown in Table 1. The 1968 discoveries are listed in Table 2 and the dry exploratory tests are shown in Table 3 and their locations on Figure 8. The breakdown of completions is shown in Table 4 and the old wells drilled deeper in Table 5. Figure 9 is a graph showing the shallow well activity from 1950 to 1968 while Figure 10 is a graph of the annual rate of deep sand exploration and development from 1930 to 1968.

At the end of 1968, a total of 2,938 deep wells had been drilled in the Commonwealth. Of the 2,938 deep wells, 1,746 were gas wells, 6 were oil and gas wells, 1,065 were dry holes, 117 were drilled for gas storage, and 4 are being used for waste disposal.

A total footage of 1,834,131 feet was drilled in 1968. Of this total 1,373,480 feet was development footage, 167,490 feet wildcat, service wells 152,585 feet, miscellaneous wells 139,378 feet, and 1,198 feet of stratigraphic test hole.

Table 1. *Completion Summary, Pennsylvania, 1968**

<i>Completions</i>	<i>Oil</i>	<i>Gas</i>	<i>Dry</i>	<i>Total</i>	<i>Successful (%)</i>
Exploration . . .	9	14	38	61	38
Development . .	462	240	32	734	96
Totals	471	254	70	795	91

* Does not include service wells, miscellaneous wells, or stratigraphic/core tests.

PRODUCTION AND RESERVES

Oil production decreased 7 percent (4,101,000 barrels in 1968, 4,387,000 barrels in 1967), and gas production decreased 1 percent (87,987 MMCF in 1968, 89,966 MMCF in 1967) this year (Table 6). Oil reserves were down a little over 6 percent (59,188,000 barrels in 1968, 63,289,000 barrels in 1967) and gas reserves were down 3 percent (1,344,996 MMCF in 1968, 1,392,170 MMCF in 1967) this year.

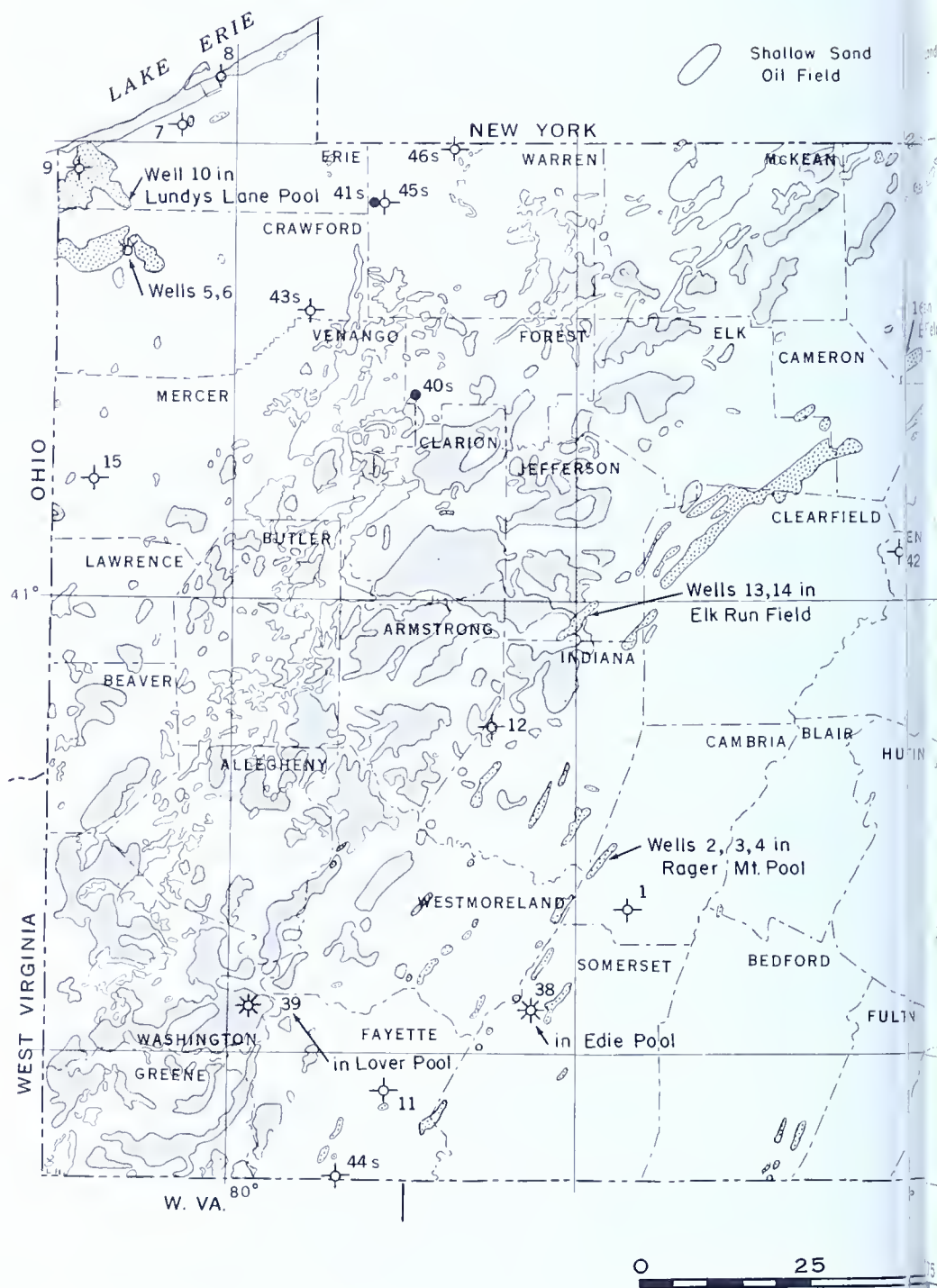


Figure 8. Oil and gas developments in 1968

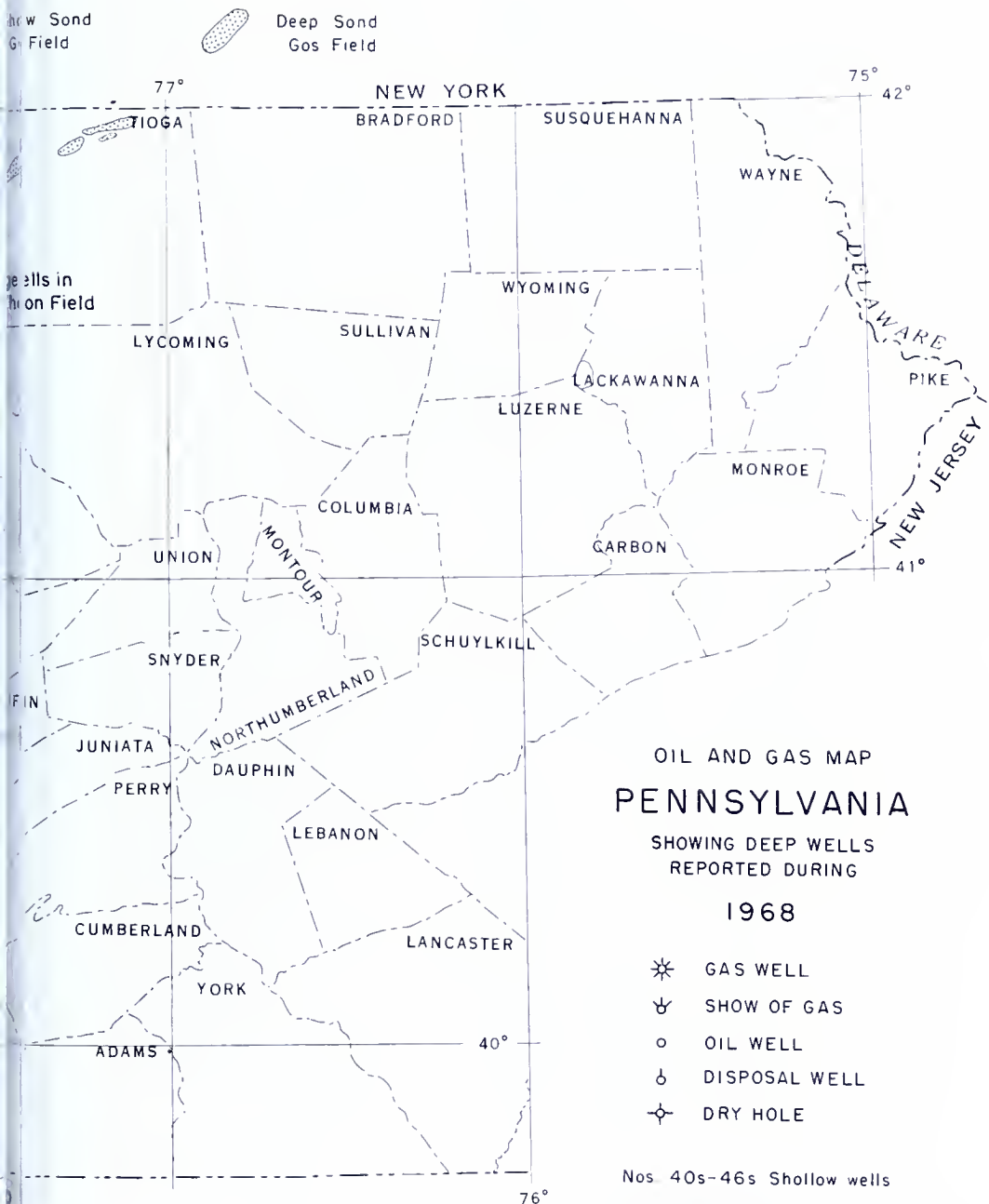


Table 2. Discoveries in 1968, Pennsylvania

Map No.	County	Operator Well No. and Lease	Compl. Date	Basis for Loc.	Total Depth (Ft.)	Name of Formation at TD	Prod. Depth (Ft.)	Prod. Form. or Zone	Initial Daily Prod.	Field Name	Explor. Class	Remarks
40	Forest	Taylor and others 1 Vern Taylor, Inc.	1/20		861	Venango Group	829	Venango Group	8	Indian Camp	NFD	
41	Warren	Allen Oil and Gas 1 Linn Thomas	6/10	Sub. Geol.	604	Venango Group	565	Venango Group	2	Picadilli	NFD	New field north of Sanford field.
38	Somerset	Peoples Nat. Gas. Co. 1 Charles E. Berkey	10/18	Seismic	8840	Helderberg	7831	Onondaga Chert Oriskany Sandstone	825 MCF	Edie Pool	NPD	West flank Boswell dome.
39	Washington	Snee and Eberly and others 1 Duane Duvall	8/14	Seismic	8737	Salina	7881	Onondaga Chert Oriskany Sandstone	1500 MCF	Lover Pool	DPD	Deeper pool discovery on Bellevue anticline.

NFD— NPD— DPD—

Table 3. *Exploratory Failures in 1968, Pennsylvania*

<i>Map No.</i>	<i>County</i>	<i>Operator Well No. and Lease</i>	<i>Compl. Date</i>	<i>Basis for Loc.</i>	<i>Total Depth (Ft.)</i>	<i>Name of Formation at TD</i>	<i>Explor. Class or Field</i>	<i>Remarks</i>
1	Cambria	Pennzoil United, Inc. 1 F. W. Heidingsfelder	5/23	Sur. Geol.	9588	Helderberg	NFW	Southern end of Ebensburg anticline.
42	Centre	Earl H. Linn 1 Allen G. Butler	10/20	Sur. and Sub. Geol.	3520	Canadaway Group	NFW	Laurel Hill anticline.
43	Crawford	Donald C. Frederick 1 Kenneth Muir	8/16	Sub. Geol.	820	Conewango Group	NFW	
11	Fayette	Snee and Eberly and others 1 E. Stewart Hrs.	1/17	Seismic	7939	Hamilton	NFW	Faulted in Hamilton.
44		Mfg. Light and Heat Co. 1 Robert Gray	7/21	Sub. Geol.	3200	Canadaway Group	NFW	Limits Sandy Creek field on west.
12	Indiana	Peoples Nat. Gas Co. 1 Ray Orr	9/12	Seismic	7465	Oriskany	NFW	Northern end of Dutch Run anticline.
15	Mercer	R. E. Fox 1 G. and J. McBurney	9/8	Sur. and Sub. Geol. Seismic	3705	Oriskany	NFW	Northeast of Wheatland field.
45	Warren	Allen Oil and Gas 1 H. Spencer	9/5	Sub. Geol.	585	Venango Group	NFW	Sands saturated with fresh water.
46		Taurus Oil Co. 1 Hinsdale	6/1	Sub. Geol.	742	Conneaut Group	NFW	Shows limit of Glade Sandstone to west.

NFW—

Table 4. Well Completions in Pennsylvania, 1968*

County	TOTAL			GAS			OIL			DRY		
	No. of Wells	Aver. Total Depth (feet)	No. of Wells	Aver. Init. Open-Flow (MCFGPD)	Aver. Total Depth (feet)	No. of Wells	Aver. Init. Production (BOPD)	Aver. Total Depth (feet)	No. of Wells	Aver. Total Depth (feet)	No. of Wells	Aver. Total Depth (feet)
Allegheny.....	2	2,957	1	200	3,690	—	—	—	1	2,223	—	—
Armstrong.....	26	3,220	24	423	3,023	—	—	—	2	5,480	—	—
Beaver.....	1	1,315	—	—	—	—	—	—	1	1,315	—	—
Butler.....	4	1,416	1	72	1,240	2	2	1,559	1	1,303	—	—
Cambria.....	4	8,358	3	18,052	7,948	—	—	—	1	9,588	—	—
Clarion.....	12	2,265	8	66	2,593	2	65	1,978	2	1,213	—	—
Centre.....	1	3,520	—	—	—	—	—	—	1	3,520	—	—
Clearfield.....	2	3,331	1	70	3,194	—	—	—	1	3,468	—	—
Crawford.....	19	3,840	14	1,351	3,975	—	—	—	5	3,701	—	—
Elk.....	15	2,020	6	258	1,990	8	22	1,980	1	2,572	—	—
Erie.....	9	3,013	5	1,126	3,463	—	—	—	4	2,450	—	—
Forest.....	34	903	—	—	—	29	32	913	5	839	—	—
Fayette.....	2	5,569	—	—	—	—	—	—	2	5,569	—	—
Indiana.....	106	3,515	101	950	3,510	—	—	—	5	3,695	—	—
Jefferson.....	50	3,940	45	1,551	4,030	1	2	1,354	4	3,515	—	—
Lawrence.....	1	355	—	—	—	1	11	355	—	—	—	—
McKean.....	144	1,640	4	187	2,222	134	14	1,620	6	1,863	—	—
Mercer.....	1	3,705	—	—	—	—	—	—	1	3,705	—	—
Potter.....	5	1,328	—	—	—	2	6	1,376	3	1,295	—	—
Somerset.....	1	8,840	1	852	8,840	—	—	—	—	—	—	—
Venango.....	54	803	—	—	—	52	10	787	2	1,190	—	—
Warren.....	252	829	1	80	1,378	238	25	822	13	907	—	—
Washington.....	7	4,760	4	566	5,652	1	2	1,865	2	4,421	—	—
Westmoreland.....	17	4,210	14	765	3,680	—	—	—	3	6,692	—	—
Total.....	769	1,984	233	1,180	3,610	470	20	1,080	66	2,640	—	—

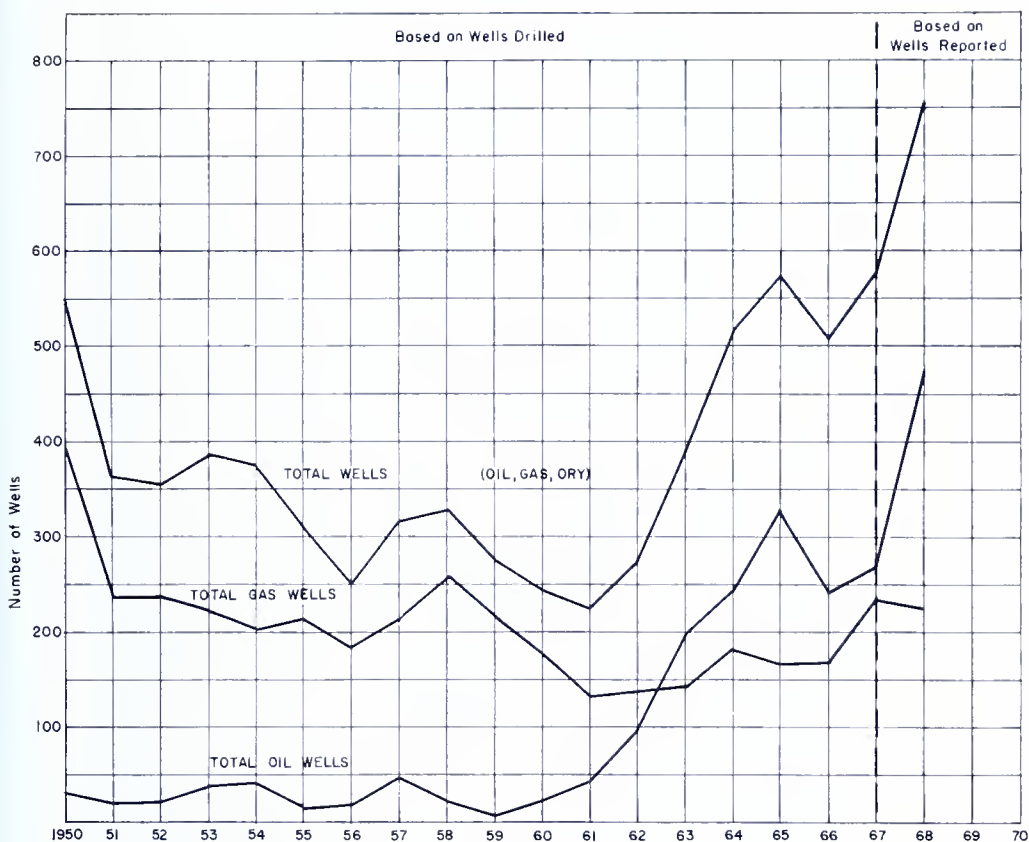


Figure 9. Shallow well activity in Pennsylvania.

Oil production averaged 11,397 BOPD (barrels of oil per day) in 1968. The total oil production for Pennsylvania during the year was 4,101,000 BO.

Excluded from the 4,101,000 BO for 1968 are 59,000 barrels of Corning-grade crude oil produced from the Medina Sandstone (Lower Silurian) in Crawford and Erie Counties. Table 7 shows yearly production of Corning-grade oil for 1965 to 1968 inclusive.

The daily average production for the Pennsylvania portion of the Bradford field was 6,824 BOPD in 1968 as compared with 6,918 BOPD in 1967. In the Middle and Southwestern Districts of Pennsylvania the daily average production in 1968 was 4,268 BOPD as compared with 5,101 BOPD in 1967.

Figure 11 shows the annual production of crude oil in Pennsylvania from 1859 to 1968 and for the Bradford District from 1871 to 1968. The monthly variation in crude oil price, production, and well completions is plotted in Figure 12 for the years 1930 to 1968 for the Bradford District.

Table 5. *Old Wells Drilled Deeper in Pennsylvania, 1968**

County	TOTAL			GAS			OIL			DRY		
	No. of Wells	Aver. Amt. Deepened (feet)	No. of Wells	Aver. Init. Open-Flow (MCFGPD)	Aver. Amt. Deepened (feet)	No. of Wells	Aver. Init. Production (BOPD)	Aver. Amt. Deepened (feet)	No. of Wells	Aver. Amt. Deepened (feet)	No. of Wells	Aver. Amt. Deepened (feet)
Allegheny.....	2	62	—	—	—	1	4	46	1	78	—	—
Armstrong.....	11	549	11	474	549	—	—	—	—	—	—	—
Butler.....	1	934	—	—	—	—	—	—	1	934	—	—
Clarion.....	1	122	1	11	122	—	—	—	—	—	—	—
Greene.....	1	440	1	683	440	—	—	—	—	—	—	—
Indiana.....	6	898	5	523	656	—	—	—	1	2,108	—	—
Westmoreland..	4	1,628	3	696	1,251	—	—	—	1	1,960	—	—
Total.....	26	722	21	505	649	1	4	46	4	1,270	—	—

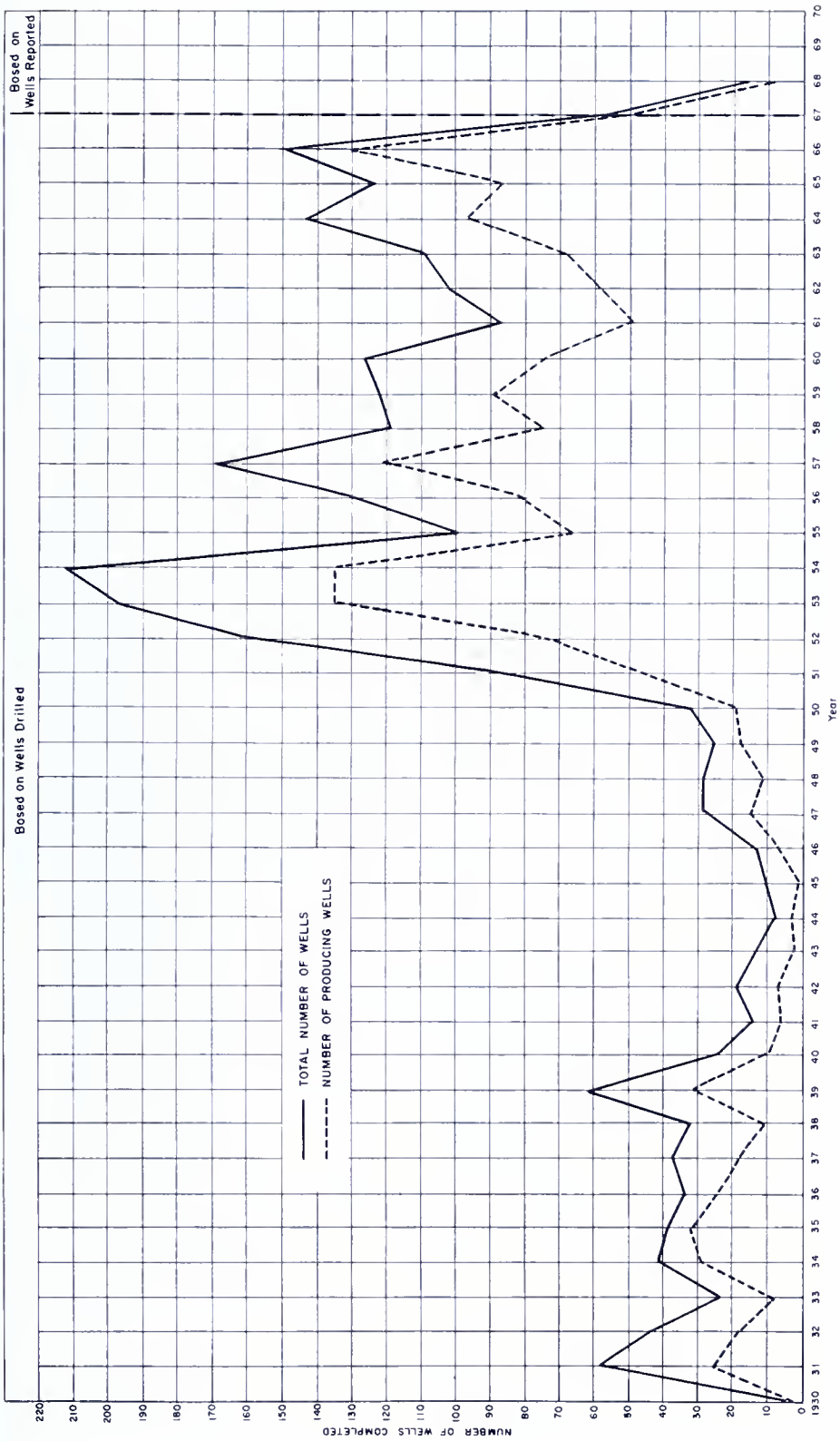


Figure 10. Annual rate of deep sand exploration and development in Pennsylvania.

Table 6. *Production in Pennsylvania, 1968*

		<i>Production</i>			<i>Reserves</i>	
				<i>Cumulative Total to</i>		
		<i>1967</i>	<i>1968</i>	<i>12/31/68</i>	<i>12/31/67</i>	<i>12/31/68</i>
Oil	Pennsylvania					
(1,000 bbl)	Grade	4,387	4,101	1,260,929	63,289	59,188
	Corning Grade	22	59	97	—	—
	Natural Gas					
	Liquids	73	98	—	1,162	1,064
Gas (MMCF)		89,966	87,987	8,370,487	1,392,170	1,344,996*

*Includes 486,524 stored

Gas production totaled 87,987,000 MCF during the year. The shallow gas produced was 62,090,000 MCF at a value of \$15,522,500 as compared with 60,506,000 MCF produced in 1967. The deep gas production amounted to 25,897,000 MCF at a value of \$7,121,675 as compared with 29,460,000 MCF produced in 1967. The annual production of natural gas in Pennsylvania from 1882 to 1968 is shown in Figure 13. The deep gas production by field and pool is shown for 1968 in Table 8. The cumulative oil and gas production and reserves are shown in Table 6. Natural gas liquid production amounted to 98,000 bbl in 1968 compared with 73,000 bbl in 1967. Reserves of natural gas liquids decreased from 1,162,000 bbl in 1967 to 1,064,000 bbl in 1968.

Table 7. *Production of Corning-Grade Crude, Pennsylvania, 1965-1968*

<i>Year</i>	<i>Barrels of Crude Oil</i>		
	<i>Crawford Co.</i>	<i>Erie Co.</i>	<i>Grand Total</i>
1965 July-December	2,873	1,549	4,422
1966	8,682	3,239	11,921
1967	20,184	1,770	21,954
1968	57,694	1,297	58,991
Totals	89,433	7,855	97,288

GAS STORAGE FIELDS

There are 65 active natural gas storage projects in the Commonwealth. The total amount of gas stored as of 12/31/68 was 486,524,000 MCF

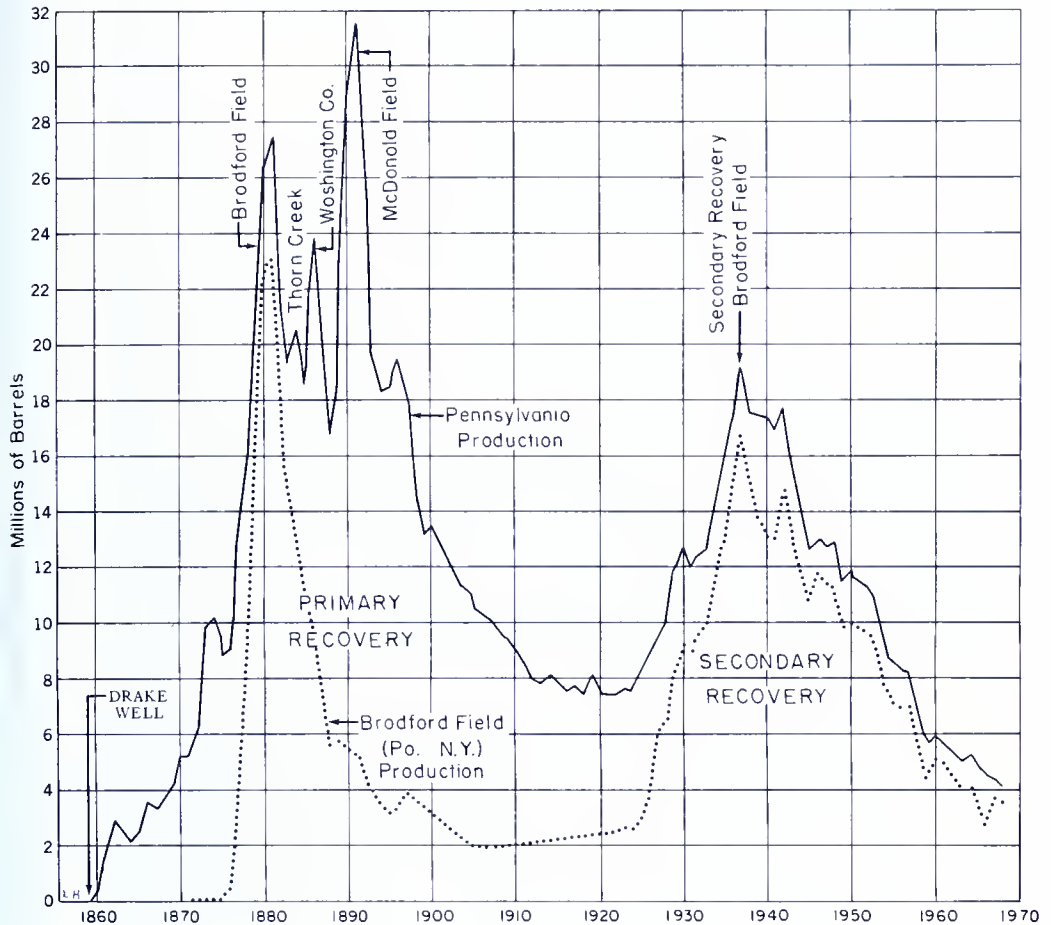


Figure 11. Annual production of crude oil in Pennsylvania.

while the total storage capacity is estimated at 695,543,072 MCF. In 1963, the Pennsylvania Geological Survey published a report and listing of these fields (*Underground Storage of Natural Gas in Pennsylvania*, W. S. Lytle, M 46, 31 p.). The listing included 61 known gas fields converted to storage as of the beginning of 1961. Since that date, one field has been abandoned (Kirby field, Greene County), and the following five gas fields have been newly converted to storage: Fair-Helm in Armstrong County, Kasey field in Butler County, Greenlick field in Clinton County, and the Ellisburg and Wharton fields in Potter County. Although the resultant change in eight years has been a less than 1 percent increase in stored gas, the ultimate capacity has been increased by 40 percent with the additional new fields. At the beginning of 1961, nearly 98 percent of ultimate capacity incorporated maximum storage. At the present time,

70 percent of ultimate capacity is utilized for maximum gas storage. The distribution of fields by counties is as follows:

Allegheny 5	Greene 3
Armstrong 2	Jefferson 6
Butler 5	McKean 4
Clarion 1	Warren 3
Clinton 2	Mercer 1
Elk 5	Potter 5
Eric 2	Tioga 4
Forest 2	Washington 10

Westmoreland 5

Gas is being stored in sandstone stratigraphic traps of the Pennsylvanian, Mississippian, Upper Devonian, and Lower Silurian (Medina), and structural traps of the Lower Devonian (Oriskany). Reservoir zones range from 1,000 to somewhat over 6,000 feet in depth, and total reservoir capacity varies from a one well 40 acre, one zone, 7 MMCF storage field to a multizone field having in excess of 34,000 acres and 260 wells with over 110,000 MMCF total storage capacity.

SUBSURFACE DISPOSAL FOR OTHER INDUSTRY

Interest in subsurface disposal of pollutant and industrial effluents has recently expanded in Pennsylvania as it has elsewhere in and about major industrial areas and population centers. This has been accompanied by widespread concern over publicized pollution of air and contamination of surface and shallow subsurface water which properly merits attention. In many areas of the country, disposal of waste in the subsurface has been more economical than chemical and physical pretreatment before surface discharge or in processing wastes for other uses. Having a multiplicity of underground reservoirs and the advantage of possible further recovery of hydrocarbons through disposal flooding, the subsurface of western Pennsylvania is beginning to receive considerable attention by many diversified industries.

Within the past year, there are known to have been at least seven disposal projects undergoing consideration for major industry within the State. The actual number of projects being considered is probably in excess of this figure which, if successfully carried out, would double the number of disposal wells in Pennsylvania. Involved in these investigations are at least two major industrial companies and five consulting firms. These brief notes regarding subsurface disposal are included in order to bring this rapidly expanding field to the attention of the oil and gas industry of the State, which collectively controls much of the subsurface rights in western Pennsylvania and which has the expertise from

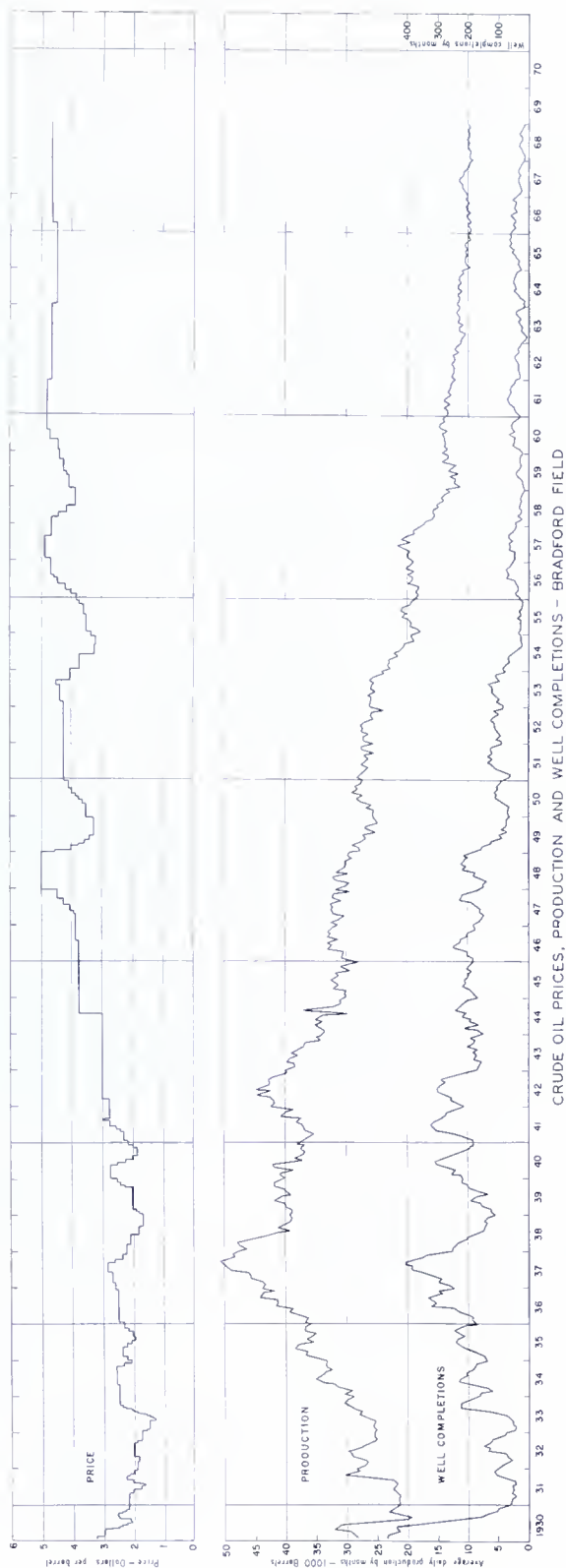


Figure 12. Crude oil prices, production and completions, Bradford field.

Table 8. Deep Gas Production in Pennsylvania, 1968
(Production in MCF)

County	Field	Pool	Discovery Date	Cumulative Production at End of 1967	Production 1968	Cumulative Production End of 1968	Status of Field or Pool at End of 1968
Armstrong.....	Shellhammer*	Rupert	11/14/58	355,596	4,826	360,422	Producing
Bedford.....	Artemus	TOTAL	7/30/63	2,364,000	39,000	2,403,000	Producing
		Artemus	7/30/63	1,565,000	12,000	1,577,000	Producing
		Pennland	8/28/64	799,000	27,000	826,000	Producing
	Big Mt.		10/ 6/64	716,000	11,000	727,000	Producing
	Five Forks		6/21/62	14,241,000	248,000	14,489,000	Producing
	Purcell		12/14/57	2,981,000	53,000	3,034,000	Producing
Cambria.....	Rager Mt.		10/16/65	2,147,886	2,747,914	4,895,800	Producing
Cameron & Elk.....	Whippoorwill		7/10/61	12,915,000	514,000	13,429,000	Producing
Cameron, Elk,							
Jefferson, Clearfield	Punxsutawney*	TOTAL	9/15/51	457,377,000**	4,637,000	462,014,000	Producing
and Indiana.....	Driftwood	Benezette	1/ 5/53	238,377,000	1,451,000	239,828,000	Producing
		Driftwood	9/15/51				Producing
		Boone Mt.	9/18/58	95,779,000**	1,538,000	97,317,000	Producing
		Dubois	1/ 6/60				Producing
		Sabula	8/26/63	679,000	56,000	735,000	Producing
		Helvetia	5/11/60				Producing
		Reed-	5/ 9/55				Producing
		Deemer	12/11/53	118,835,000	1,503,000	120,338,000	Producing
		Rockton	2/25/55				Producing
		Sykesville	11/10/60				Producing
		Hicks Run	6/ 7/56	3,707,000	89,000	3,796,000	Producing
		TOTAL	1/ 9/50	159,648,230	123,759	159,771,989	Gas Storage and Prod.
Clinton and Potter.....	Leidy	Ole Bull	1/ 9/59	4,848,198	123,759	4,971,957	Producing

Table 8.—Continued

County	Field	Pool	Discovery Date	Cumulative Production at End of 1967	Production 1968	Cumulative Production at End of 1968	Status of Field or Pool at End of 1968
Crawford and Erie.....	Conneaut	TOTAL	2/11/57	18,858,112	2,980,947	21,649,059	Producing and Aban.
		Bushnell-					
		Lexington	12/31/58	9,248,769	1,338,552	10,587,321	Producing
		Indian Spring	9/11/57	6,373,858	925,500	7,299,358	Producing
		Kastle	7/14/62	1,363,000	346,000	1,709,000	Producing
Erie.....	Burgess	Lundys Lane	11/ 9/61	917,701	221,646	1,139,347	Producing
		Pierce	12/31/58	764,784	149,249	914,033	Producing
		TOTAL	10/17/60	121,770	5,782	127,552	Producing
		Corry	4/29/47	1,014,314	7,122	1,021,436	Gas Storage and Prod.
		Beaver Dam	5/20/53	160,614	7,122	167,736	Producing
Fayette.....	Meade		8/23/46	4,904,441	5,342	4,909,783	Oriskany Gas Storage (One Producing Medina Well)
		Fike	8/ 8/63	188,018	92,678	280,696	Producing
		Ohioyle	12/28/59	3,250,768	181,839	3,432,607	Producing
		Spruell	10/13/61	297,454	408,975	706,429	Producing
		Summit	3/24/38	41,461,516	277,293	41,738,809	Producing and Aban.
Indiana.....	Cherry Hill*	TOTAL	3/24/38	20,638,758	60,000	20,698,758	Producing
		North Summit	5/ 9/42	20,754,949	217,293	20,972,242	Producing
		South Summit	1/ 9/63	2,245,832	120,762	2,366,594	Producing
		Crichton } Hadden }	7/11/63				
		Jacksonville	9/21/56	24,981,777	388,307	25,370,084	Producing
Jefferson.....	Nolo		9/30/56	6,727,000	137,000	6,864,000	Producing
		Big Run	6/30/65	22,800,000	9,238,000	32,038,000	Producing
		Wheatland	7/24/63	65,923	25,495	91,418	Producing
		Ulysses	10/ 2/39 }				
		Potter	4/ 2/62 }	2,994,718	160,598	3,155,316	Producing

Table 8.—Continued

County	Field	Pool	Discovery Date	Cumulative Production at End of 1967	Production 1968	Cumulative Production at End of 1968	Status of Field or Pool at End of 1968
Somerset.....	Boswell	TOTAL	11/11/58	9,043,618	502,088	9,545,706	Producing
		Boswell	11/11/58	8,289,332	453,687	8,743,019	Producing
		Snyder	6/16/60	754,286	48,401	802,687	Producing
Washington.....	Daniels Run*	Glyde	9/ 6/61	60,538	7,362	67,900	Producing
		Lover	8/14/68		7,506	7,506	Producing
Westmoreland.....	Blairsville*	Kahl	10/23/62	6,438,176	698,297	7,136,473	Producing
		Dry Ridge	8/25/46	4,089,670	362,265	4,451,935	Producing
	Latrobe*	Bailey	12/26/61	563,162	87,144	650,306	Producing
	Jacobs Creek*	TOTAL	8/17/49	5,586,907	109,974	5,696,881	Producing and Aban.
	Lycippus	St. Boniface					
Westmoreland and Somerset.....	Johnstown	Chapel	9/13/56	4,847,479	109,974	4,957,453	Producing
		TOTAL	11/ 3/1878	278,365	60,860	339,225	Producing
		Sloan	10/22/63	109,814	12,979	122,793	Producing
		Duquesne	8/ 8/65	168,551	47,881	216,432	Producing
		TOTAL	5/16/57	19,179,305	1,221,085	20,400,390	Producing
Westmoreland and Somerset.....	Johnstown	Baldwin	5/22/60	6,596,717	447,444	7,044,161	Producing
		Beck	5/16/57				
	Seven Springs	Williams	2/14/58	12,582,588	773,641	13,356,229	Producing
		TOTAL	12/ 5/58	5,992,462	431,904	6,424,366	Producing and Aban.
		Blair	12/ 5/58	5,137,522	208,620	5,346,142	Producing
		Tunnel	3/10/65				
		Seven Springs	8/ 3/66	131,517	223,284	354,801	Producing

* "Shallow" gas production of field not shown

** Corrected figures

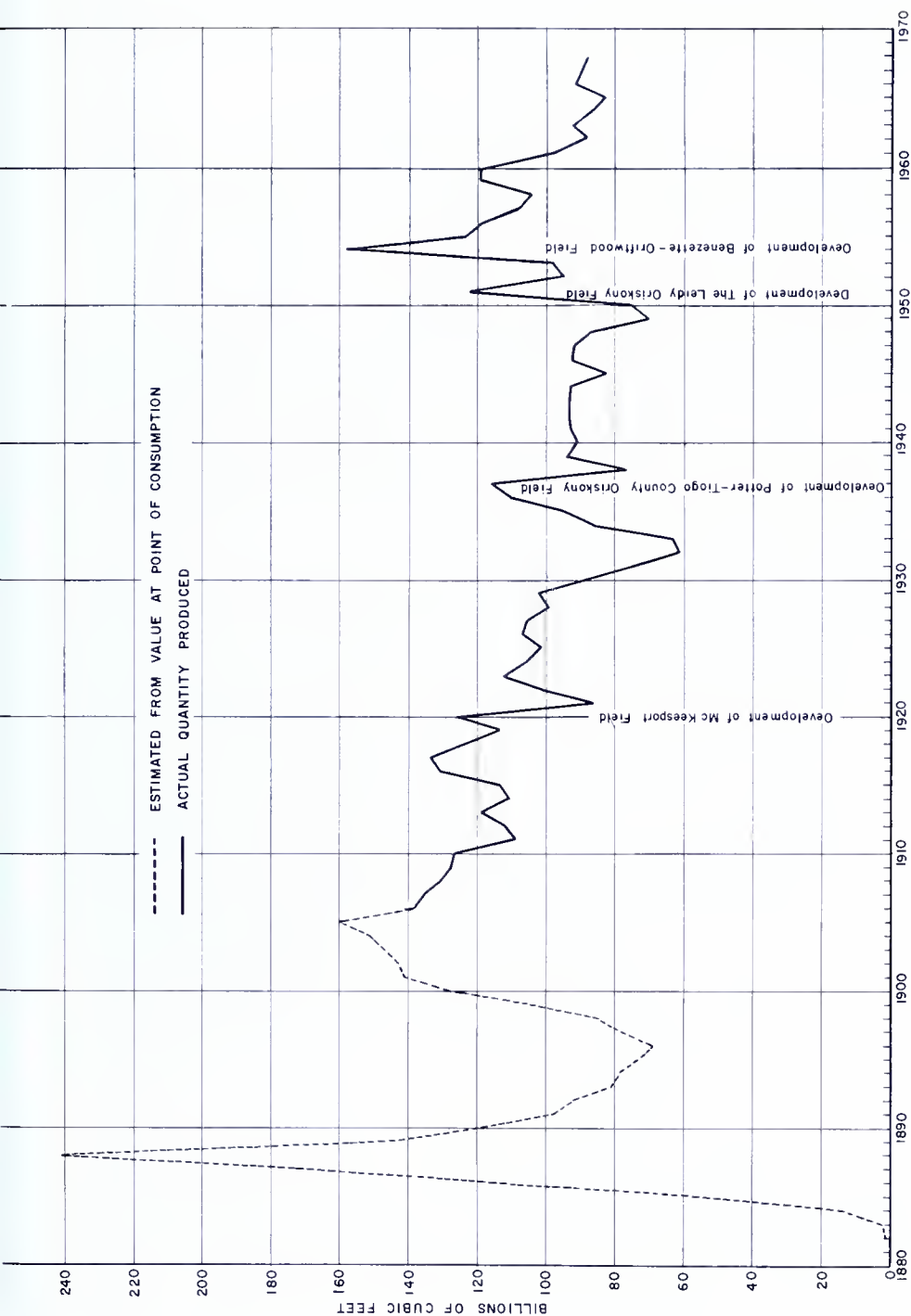


Figure 13. Annual production of natural gas in Pennsylvania.

which guidance for optimum economic utilization or development of subsurface resources should be expected.

One disposal well was drilled and completed in 1968. At the present time, Pennsylvania is known to have subsurface disposal projects as listed in Table 9.

OIL AND GAS PRICES

Crude oil prices during the year are shown in Table 10. There was no change from 1967 prices. The price for gas averages \$0.275 per MCF.

LAND SALES

The Pennsylvania Game Commission leased tracts 103A, 103B, and 103C at a royalty bid of \$.04 per MCF of gas and a rental of \$1.00 per acre on a total of 4,879 acres in Union and Boggs Townships, Centre County. At the end of 1968, the Commission had 28 active leases totaling 13,328 acres. Thirty-four wells were producing on seventeen of these leases. A total of three new wells were drilled on Game Commission lands during the year.

During 1968, all of the Commonwealth's acreage under Lake Erie which comprises 369,989 acres was offered to the oil and gas industry for lease through competitive bidding. Of the 37 blocks offered, 4 blocks comprising 24,509 acres were leased for oil and gas exploration. The highest bonus bid for this acreage was \$6 per acre. A total bonus of \$128,031.81 was received for these four tracts which carry a yearly rental of \$1 per acre.

Also through competitive bidding 15,897 acres of on-shore State Forest lands were leased for up to \$4.62 per acre. A total bonus of \$50,266.88 was received for those tracts which carry a yearly rental of \$1 per acre.

At the end of 1968, there were 151,191 acres, including 59,109 acres in gas storage, of State Forest lands under lease for oil and gas exploration and development. The total rental and royalty payments received relative to oil and gas exploration and development on State Forest lands amounted to \$549,764.00.

GEOPHYSICAL ACTIVITY

There were no gravity or magnetometer surveys reported in Pennsylvania during 1968. Seismic evaluation, however, increased from 17 crew weeks in 1967 to 23 crew weeks this past year. This activity was centered in two areas, immediately in front of the folded belt in central western Pennsylvania in Indiana, Clarion, Armstrong, and Cambria Counties, and in Washington and Greene Counties in the extreme southwestern corner of the State.

Table 9. *Subsurface Disposal Projects in Pennsylvania**

Project and Operator	15-Minute Quad- range, Section, Survey Map No.	County	Disposal Horizon			Initial Completion			Notes		
			Depth (feet)	Forma- tion	General Rock Type	Type of Waste	Injection Rate (GPM)	Injection Pressure (psi)		Date	Status
Aliquippa Jones and Laughlin Steel Corporation	Sewickley D, 2 (Deep)	Beaver	5253- 5445	Onondaga Oriskany	Chert Sandstone	Steel Mill Pickle	100	3850	1-1966	Shut-in	Other higher zones being considered for disposal.
Colerain Twp. Gulf Re- search and Development	Clearville A, # 33 (Deep)	Bedford	560	Bellefonte	Dolomite	Drilling Mud	*	12-1964	Aban- doned	1000-1300	*P iodic injections amounted to 70,350 gallons cumulative.
Franklin Boro. Bethlehem Steel Company	Johns- town, E, # 3 (Shallow)	Cambria	570-835	Big Injun	Sandstone	Weak Ammonia Liquor	—	—	1-1966	Aban- doned	Inadequate reservoir on testing.
Erie	Erie	Erie	1620-1670	Bass Islands	Dolomite	Spent	350	1100	11-1965	Active	
Hammermill Paper Com- pany # 1	F, 109 (Deep)					Sulfite Pulping Liquor					

Table 9.—Continued

Project and Operator	15-Minute Quad-range, Section, Survey Map No.	County	Disposal Horizon			Initial Completion				Notes	
			Depth (feet)	Formation	General Rock Type	Type of Waste	Injection Rate (GPM)	Injection Pressure (psi)	Date		Status
Erie	Erie	Erie	1620-1710	Bass Islands	Dolomite	Spent	600-800	1100	9-1965	Shut-in	
Hammernill F, 110 Paper Company #2	(Deep)					Sulfite					
			*5100-5972	Gatesburg	Sandstone	Pulping Liquor	—	—	—	*	*Gatesburg tested, not used for disposal.
Erie	Erie	Erie	1620-1718	Bass Islands	Dolomite	Spent	831	1100	8-1968	Active	
Hammernill F, 113 Paper Company #3	(Deep)					Sulfite					
					Pulping Liquor						
W. Bethlehem Twp. Bethlehem Steel Company	Amity H, 86 (Shallow)	Washington	1300-1588	"Salt"	Sandstone	Acid Mine Water	—	—	2-1966	Abandoned	Inadequately developed reservoir.

* Data from the Pennsylvania Department of Health.

Table 10. *Crude Oil Prices per Barrel, Pennsylvania, 1968*

<i>Date</i>	<i>Bradford District</i>	<i>Middle District</i>	<i>Southwestern District</i>
Jan. 1-Dec. 31, 1968	\$4.63	\$4.35	\$4.08

CHANGES IN OIL AND GAS LAWS

During 1968, amendments to the Oil and Gas Laws of Pennsylvania were submitted and approved (House Bill 900). The Department of Mines and Mineral Industries, Oil and Gas Division is planning to issue a new up-to-date compilation of these laws **in the very near future**. The amendments have clarified a number of the regulations governing oil and gas well drilling, completion, and abandonment. Completion date is now specified as the date of abandonment or the date the well is equipped for production. Location plats can now be prepared by surveyors as well as engineers. All wells are now covered by the Oil and Gas Laws. Drilling permits will now expire one year after issuance unless operations have commenced. Plugging laws have been made more comprehensive. Provisions have been made for increased cooperation between the Department of Mines, Oil and Gas Division and the Department of Health, Sanitary Water Board to insure better control and prevention of pollution of surface and subsurface waters from drilling and completion operations.

OTHER INDUSTRY ACTIVITIES

Project Ketch, which was a proposed experiment to determine whether it is economically and technically feasible to create a natural gas storage reservoir by detonating an atomic device at depth beneath Sproul State Forest in Clinton County, Pennsylvania, was abandoned at mid-year.

Operations are proceeding with the Maraflood Pilot Project in the Bradford field, McKean County. It has been reported that the micellar solution of the Maraflood Process has been injected into the Bradford Third Sandstone and is now being driven by the mobility buffer which in turn is to be followed by ordinary drive water. No further information is available on this project whose outcome is of extreme interest, especially to the operators in the Bradford field.

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1968

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APPENDIX

DEEP WELL STATISTICS AND SUMMARIZED RECORDS
OF DEEP WELLS

Deep well statistics in this report are compiled on a system different from the past. Previously, the wells reported in a specific year were those actually completed during that year whether Department of Mines and Mineral Industries official reports had been received or not. In this report, however, only those wells reported to the Survey by the Department of Mines and Mineral Industries during 1968 are considered as statistics for the calendar year 1968. Therefore, wells drilled in 1967 and reported in 1968 are included as 1968 wells. Similarly, wells drilled in 1968 and not received from Mines and Minerals until 1969 will be included as 1969 wells.

The reason for the change is similar to that of shallow well reporting, and that is to comply with requests from the Committee for Statistics of Drilling (CSD) of the American Association of Petroleum Geologists (AAPG) for standardization of reporting. Weekly well reports are sent to CSD and these reports are based on official information received from the Department of Mines and Mineral Industries, Oil and Gas Division. Because of the weekly schedule the reports are subject to time of reporting rather than time of drilling. For the yearly published oil and gas developments to agree with the total of the weekly reports to the CSD, the same time basis of reporting should be followed.

Table 11, *Summarized records of deep wells reported in 1968*, includes one dry hole and 22 gas storage wells that were drilled in 1967. There are to date 23 deep wells known to be drilled in 1968 but reported after close of the CSD statistical period. Summarized records for these wells will be presented in the next annual Progress Report. Table 12 gives summarized records of wells drilled in 1967 and one in 1966 which were reported in their respective years but which had scanty data. These wells are repeated in this report to correct errors and report additional information. The map numbers in the first row are the same map numbers used for these wells in the 1966 (Prog. Rept. 173) and 1967 (Prog. Rept. 175) oil and gas development reports.

The information in the summarized record tables has been compiled mainly from drillers' logs and location plats received from the Oil and Gas Division of the Department of Mines and Mineral Industries. Other sources are Petroleum Information Corporation (PI), geophysical logs received by the Pennsylvania Geological Survey, and personal communications with the oil and gas operators. The map numbers in Table 11 refer only to well location numbers on the center fold map (Figure 8) of this report. The more significant numbers are the permit number by which the well is filed with the Department of Mines and Mineral Industries and the quadrangle number by which the Survey files the well and locates it on 15-minute quadrangle maps. Asterisks preceding certain depth figures indicate that the formation top has been picked from a geophysical log. Depth figures without asterisks mean that the formation top is from the drillers' log or PI.

Table 11.—Summarized Records of Deep Wells Reported in 1968

MAP NUMBER	1	2	3	4	5	6	7	8	9	10
COUNTY	CAMBERLA	CAMBERLA	CAMBERLA	CAMBERLA	CRAWFORD	CRAWFORD	ERIE	ERIE	ERIE	ERIE
Permit Number	13	12	11	10	232	226	303-P	LS-2	307-P	306
NAME OF WELL	F. W. Holdingsfelder and Gun Club	Johnston Road and Gun Club	R. T. McFadden Unit 1	Petete Coal Corp. 1	John R. Clements 2	Luther Cooper 1	Erie Skeet Assoc. 1	Hammemill 3	E. C. Boothby 1	Shkuratoff 1
OPERATOR	Pennco United, Inc.	The Peoples Nat. Gas Co.	Fairman Drilling Co.	Fairman Drilling Co.	James Drilling Corp.	James Drilling Corp.	Pa. Gas Co.	Hammemill Paper Co.	Flanigan Bros.	Merton Corp.
TOWNSHIP	Richland	Jackson	Jackson	Jackson	Spring	Spring	Mackay	City of Erie	Springfield	Elk Creek
QUADRANGLE	Johnston H 10	Johnston A 11	Johnston B 9	Johnston B 8	Girard I 382	Girard I 361	Erie H 112	Erie F 113	Girard A 384	Girard F 383
LATITUDE	6,500 ft. S 40°20'	27,100 ft. S 40°30'	15,650 ft. S 40°30'	19,100 ft. S 40°30'	26,700 ft. S 41°50'	28,100 ft. S 41°50'	17,700 ft. S 42°05'	8,700 ft. S 42°10'	23,800 ft. S 42°00'	18,200 ft. S 41°55'
LONGITUDE	4,700 ft. W 78°50'	3,100 ft. W 78°55'	15,300 ft. W 78°50'	18,350 ft. W 78°50'	19,900 ft. W 80°15'	19,300 ft. W 80°15'	19,850 ft. W 80°05'	13,400 ft. W 80°00'	12,600 ft. W 80°25'	15,000 ft. W 80°15'
DATE COMPLETED	5-23-68	8-19-68	3-13-66	1-30-68	12-27-67	1-25-68	1-29-68	5-15-68	3-26-68	3-15-68
ELEVATION	2232 KB	2257 G	2333 KB	2444 KB	1250 KB	1282 KB	995 G	647 G	801 DF	1137 KB
TULLY	*8362-8376	*6820-6038	*7110-7129	7147-7166						
ONONDAGA	9556- chert *9280-	7556- chert T582-	*7873- chert *7891-	7909- chert 7925-	26107-	2655-	1872-	1385-	1653-	2294-
ORISKANY	*9373-2386		7979-8026 100 Mcf 7979-83	8011-8058 227 Mcf 8025-56	SW @ 2800	SW @ 2845	2146- SW @ 2149	Orisk absent- water from well #2 at 1690	1933- SW @ 1935	25507- SW @ 2560
SALINA								1737-		
GUELPH - LOCKPORT Black Water					3650	3680		2120-		
CLINTON IRONDELOUIT										
MEDINA					perft: 3923-3956	perft: 3987-4006				perft: 3575-3580
QUEENSTON					4061-					3690-
MIDDLE ORDOVICIAN LIMESTONES										
GATESBURG										
TOTAL DEPTH	9588	7675	8079	8690	4068	4099	2192	2354	1911	3750
DEEPEST FORMATION REACHED	Helderberg?	Onondaga chert	Helderberg?	Helderberg?	Queenston	Nedina	Beas Islands	Lockport	Oriskany	Queenston
RESULT	Dry in Oriskany plugged & abandoned	40,000 Mcf gas natural at 7675 ft. 2572 psi 11 days	3,877 Mcf gas AF 3075 psi 72 hours	10,281 Mcf gas AF 3050 psi 72 hours	Abandoned 2 Mcf gas AF 1225 psi 48 hours	Abandoned 1.5 Mcf gas AF 1120 psi 48 hours	Abandoned 213 Mcf @ 689 251 Mcf @ 989 Both shows exhausted	Drilled for liquid waste disposal	Abandoned - Not fracked Show gas @ 700, 750	300 Mcf gas end oil AF 1020 psi 48 hours

MAP NUMBER	11	12	13	14	17	17*	17	18	19	20
COUNTY	PERMIT NUMBER	INDIANA	JEFFERSON	JEFFERSON	MERCER	POTTER	POTTER	POTTER	POTTER	POTTER
NAME OF WELL	58	1116	538	553	41	222	223	224	216	217
OPERATOR	Elizabeth Stewart et al	Ray Orr	Lindsay Coal Co. 1	John Zeedick 1	D. & J. McMurney 1	Pe. State Forest Wh 74	Pe. State Forest Wh 75	Pe. State Forest Wh 76	Pe. State Forest Wh 67	Pe. State Forest Wh 68
OPERATOR	Snee & Eberly et al	The Peoples Nat. Gas Co.	Consol. Gas Supply Corp.	Consol. Gas Supply Corp.	R. E. Fox	United Nat. Gas Co.	United Nat. Gas Co.	United Nat. Gas Co.	United Nat. Gas Co.	United Nat. Gas Co.
TOWNSHIP	Dunbar	Washington	Young	McClummet	Hickory	Wharton	Wharton	Wharton	Wharton	Wharton
QUADRANGLE	Uniontown F 43	Indiana A 30	Smicksburg C 34	Pinxtenway A 62	Sherango H 6	Conrad G 39	Conrad G 40	Conrad G 41	Conrad G 42	Conrad G 43
LATITUDE	1,600 ft. S 39°55'	12,600 ft. S 40°45'	22,150 ft. S 41°00'	450 ft. S 41°00'	27,300 ft. S 41°20'	25,550 ft. S 41°35'	27,150 ft. S 41°35'	24,550 ft. S 41°35'	27,000 ft. S 41°35'	29,500 ft. S 41°35'
LONGITUDE	15,400 ft. W 79°30'	19,600 ft. W 79°10'	2,700 ft. W 79°00'	8,500 ft. W 78°55'	19,100 ft. W 80°20'	16,700 ft. W 77°55'	14,550 ft. W 77°55'	15,100 ft. W 77°55'	21,100 ft. W 77°55'	18,300 ft. W 77°55'
DATE COMPLETED	1-18-68	9-13-68	1-18-68	5-15-68	9-8-68	6-9-67	4-25-67	6-9-67	8-24-67	7-6-67
ELEVATION	2258 KB	1135 KB	1218 G	1522 DF	1169 G	2116 KB	2123 KB	2024 KB	1849 KB	1931 KB
TULLY	6892-6980	*6766-*6892	*6426-*6560	*6836-*6964	3535 (estimate)	5584-5655	5630-5699	5522-5589	5282-5353	5393-5467
DRISKANY	Not reached - resulting in Hamilton	*7332- *7346- 7460- SW @ 7465	*7007- *7027- *7109- 2778 Mcf 7114-7132	*7402- *7420- Gas *7496- Gas @ 7496	3695- SW, 5G	6284- 6304- Gas	6325- 6344- Gas	6225- 6238- Gas	5980- 5998- Gas	6091- 6105- Gas
HELDERBERG			*7132-	*75021 -		6335-	6372-	6271-	6031-	6135-
SALINA										
GUELPH - LOCKPORT										
CLINTON										
MEDINA										
QUEENSTON										
TOTAL DEPTH	7939	7465	7168	7945	3705	6391	6410	6423	6065	6174
DEEPEST FORMATION REACHED	Hamilton	Oriskany	Helderberg	Helderberg	Oriskany	Helderberg	Helderberg	Helderberg	Helderberg	Helderberg
RESULT	Abandoned without treatment	Abandoned without treatment	11,463 Mcf gas AP 1862 psi 4 days	1,400 Mcf gas Natural AP 3740 psi 9 days	Abandoned 3000 ft. SW from Oriskany	Drilled for gas storage	Drilled for gas storage	Drilled for gas storage	Drilled for gas storage	Drilled for gas storage

MAP NUMBER	31	32	33	34	35	36	37	38	39
COUNTY	POTTER	POTTER	POTTER	POTTER	POTTER	POTTER	POTTER	SCMSEN	WASHINGTON
Permit Number:	227	213	215	214	228	229	209	37	173
NAME OF WELL	Pa. State Forest Wh 61	Pa. State Forest Wh 63	Pa. State Forest Wh 66	Pa. State Forest Wh 65	Kathryn Page Wh 62	Kathryn Page Wh 64	Pa. State Forest Wh 57	C. B. Berkey 1	D. Duval 1
OPERATOR	United Nat. Gas Co.	United Nat. Gas Co.	United Nat. Gas Co.	United Nat. Gas Co.	United Nat. Gas Co.	United Nat. Gas Co.	United Nat. Gas Co.	The Peoples Nat. Gas Co.	Shue & Eberly et.al.
TOWNSHIP	Wharton	Wharton	Wharton	Wharton	Wharton	Wharton	Wharton	Lincoln	West Pike Run
QUADRANGLE	Driftwood C 117	Emporium I 14	Emporium I 15	Emporium I 16	Emporium I 17	Emporium I 18	Renovo West A 203	Someret E 31	Brownville D 2
LATITUDE	850 ft. S 41°30'	28,800 ft. S 41°35'	25,800 ft. S 41°35'	27,400 ft. S 41°35'	30,000 ft. S 41°35'	29,500 ft. S 41°35'	1,200 ft. S 41°30'	27,100 ft. S 40°10'	22,450 ft. S 40°10'
LONGITUDE	5,800 ft. W 78°00'	5,800 ft. W 78°00'	750 ft. W 78°00'	900 ft. W 78°00'	6,100 ft. W 78°00'	3,900 ft. W 78°00'	21,700 ft. W 77°55'	11,700 ft. W 79°05'	8,400 ft. W 79°55'
DATE COMPLETED	9-14-67	8-15-67	9-14-67	6-20-67	6-6-67	8-15-67	9-12-67	10-21-68	8-14-68
ELEVATION	1621 KB	1907 KB	1828 KB	1891 KB	1915 KB	1899 KB	1982 KB	2037 KB	1285 KB
TULLY	5109-5183	5424-5494	5295-5364	5329-5398	5404-5476	5335-5406	5396-5470		*7350-7737
ONONDAGA	LIMESTONE	5821-	6129-		6011-	6107-	6086-	8556- 8580-	*7798- *7814- part: 7831-7882
	CHERT								
ORISKANY	5837- Gas	6145- Gas	6030- Gas	6040- Gas	6123- Gas	6049- Gas	6102- Gas	8696- No Gas BP	*8035- part: 8042-8052
HELDERBERG	5870-	6170-	6061-	6073-	6155-	6081-	6134-	8806-	*8130-?
SALINA									86107- 8720 (Salt)
GUELPH - LOCKPORT									
CLINTON									
MEDINA									
QUEENSTON									
TOTAL DEPTH	5906	6221	6104	6105	6195	6130	6174	8853	8737
DEEPEST FORMATION REACHED	Helderberg	Helderberg	Helderberg	Helderberg	Helderberg	Helderberg	Helderberg	Helderberg	Salina
RESULT	Drilled for gas storage	Drilled for gas storage	Drilled for gas storage	Drilled for gas storage	Drilled for gas storage	Drilled for gas storage	Drilled for gas storage	452 Mcf gas 3465 psi 24 days	1500 Mcf gas 3368 psi 28 days

Table 12.--Summarized Records of Deep Wells Drilled in 1966-67 (Reported in 1968)

MAP NUMBER	5	11	16	18	23	24	28	66
COUNTY	CRAWFORD 231	CRAWFORD 228	CRAWFORD 233	CRAWFORD 229	CRAWFORD 227	CRAWFORD 230	ENIE 305	WESMORELAND 302 & 310
NAME OF WELL	C. Z. Clements 2 & A	M. E. Jamison 1	Lloyd P. Nelson 1	H. Schreiber 1	Lloyd Ward 1	John Walsh 1	Russin 1	W. D. Clark 2 & 2A
OPERATOR	James Drilling Corp.	James Drilling Corp.	James Drilling Corp.	James Drilling Corp.	James Drilling Corp.	James Drilling Corp.	Sunset Intern'l Pet. Corp.	T. W. Phillips Gas & Oil Co.
TOWNSHIP	Spring	Summerhill	Spring	Spring	Spring	Spring	Franklin	St. Clair
QUADRANGLE	Girard I 310	Girard I 300	Girard I 309	Girard I 317	Girard I 319	Girard I 318	Cambridge Springs A 22	Johnstown D 7
LATITUDE	25,200 ft. S 41°50'	29,350 ft. S 41°50'	18,600 ft. S 41°50'	23,900 ft. S 41°50'	10,500 ft. S 41°50'	18,600 ft. S 41°50'	25,900 ft. S 42°00'	11,650 ft. S 40°25'
LONGITUDE	19,200 ft. W 80°15'	20,300 ft. W 80°15'	19,500 ft. W 80°15'	20,000 ft. W 80°15'	17,300 ft. W 80°15'	21,800 ft. W 80°15'	20,900 ft. W 80°10'	18,650 ft. W 78°55'
DATE COMPLETED	11-11-67	12-30-67	7-31-67	11-18-67	12-15-67	12-14-67	3-4-66	*2 11-7-67 2A - 11-28-67
ELEVATION	1280 KB	1284 DF	1252 KB	1248 KB	1235 DF	1265 DF	1166 G	2300 G
TULLY	*2470-2505	2478	2400		2391-		2039-	73001-
DNONDAGA	*2640-	2649-	2577-	2580-	2570-	2560-	2240-	Not reached-- Faulting in Hamilton
DRISKANY	*2830- SW @ 2850	SW @ 2850	SW @ 2781	SW @ 2770	SW @ 2770	SW @ 2760	SG @ 2512	
SALINA	*2905-							
GUELPH - LOCKPORT Black Water	*3558- 3665	3690	3590	3460	3630	3680		* Well 2A was drilled 30' from Well 2 because of lost hole
CLINTON	*3800- *3870-	3889-	3768-	3814-	3778	378-	3420-	
MEDINA	*3907- perf: 3955-3990	perf: 3984, 4004-4013	perf: 3872 3886; 3903-3907	perf: 3897-3906; 3918, 3933-3938	perf: 3861-3873, 3883	perf: 3862-3875 3880-3883	perf: 3476-3479, 3507-3512	
DUEENSTON	*4085-		4001-			3993-	3624-	
MIDDLE ORDOVICIAN LIMESTONES	▲ Erratum in Table 11 of 1967 Development-Charles C. Z. Clements No. 2 to No. 1 & C. Z. Clements No. 1 to 2							
GATESBURG								
TOTAL DEPTH	4095	4109	4045	4060	3896	4011	3647	2 - 7640 2A - 6875
DEEPEST FORMATION REACHED	Queenston	Medina?	Queenston	Queenston	Medina	Queenston	Queenston	Hamilton
RESULT	4,000 Mcf Gas AF 1190 psi 48 hours	1,500 Mcf Gas AF 1175 psi 48 hours	1,600 Mcf Gas AF 1190 psi 72 hours	2,000 Mcf Gas AF 1160 psi 48 hours	300 Mcf Gas AF 1240 psi 48 hours	1,600 Mcf Gas AF 1220 psi 48 hours	Abandoned Show of gas & Blackwater AF	Abandoned Neither well treated

